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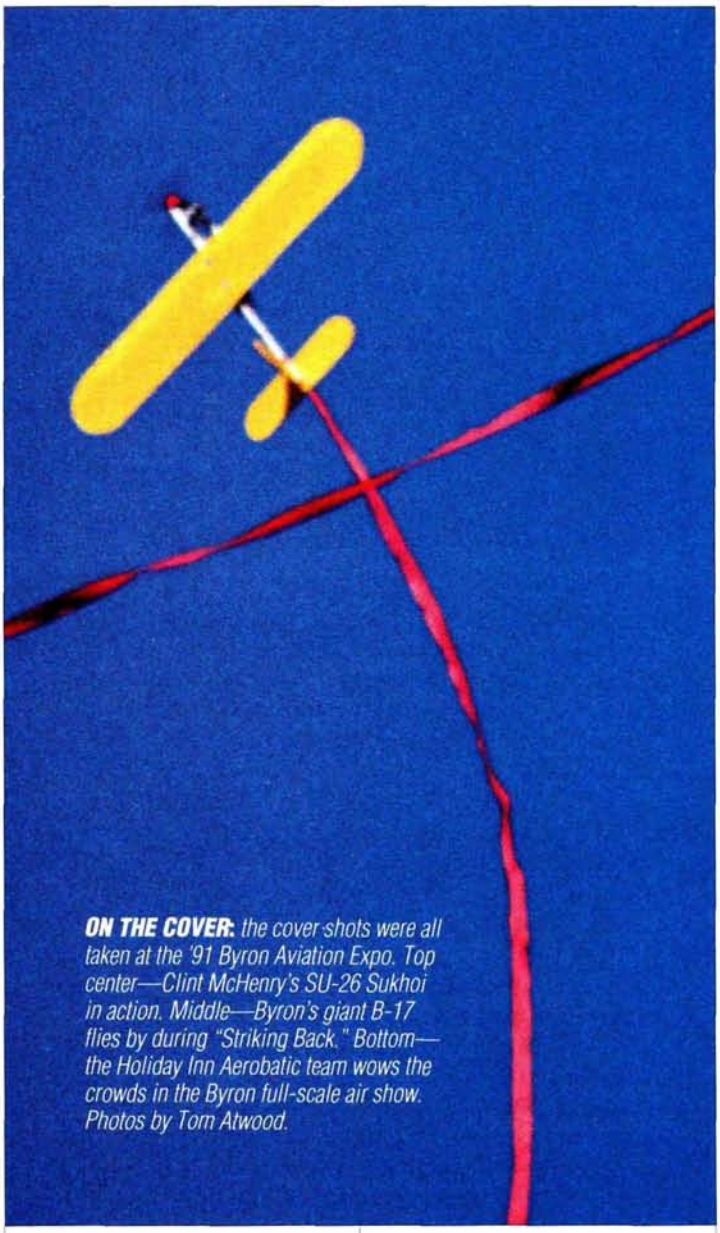
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DECEMBER 1991 VOLUME 119, NUMBER 12

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE



ON THE COVER: *the cover shots were all taken at the '91 Byron Aviation Expo. Top center—Clint McHenry's SU-26 Sukhoi in action. Middle—Byron's giant B-17 flies by during "Striking Back." Bottom—the Holiday Inn Aerobatic team wows the crowds in the Byron full-scale air show. Photos by Tom Atwood.*

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Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**, 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates are: $24.95 for 1 year (foreign, $34.95); $45.95 for 2 years (foreign $65.95). **Postmaster:** send Form 3597 to **Model Airplane News**, P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

by TOM ATWOOD



IN THE PICTURE above, I'm about to take my first flight in a North American-built P-51D Mustang, one of 80 to 100 of these venerable planes still flying. The pilot, retired Brigadier General Reg Urschler, flew this Confederate Air Force plane tirelessly throughout the Byron Aviation Expo '91. He flew exhibition flights and gave rides in return for a donation to the plane's maintenance. I told General Urschler I viewed the ride as a once-in-a-lifetime opportunity. His response: "...it's a chance of many lifetimes." Thanks to the Confederate Air Force, approximately 90 to 100 WW II planes are maintained today in flying condition, and many fly in air shows around the country. The CAF also puts on an annual air show at its Midland, TX, headquarters each October. If you want more information on the CAF, you can contact Norma Webb, Confederate Air Force, 9600 Wright Dr., Midland, TX 79711.

We're always pleased to see the emergence of new R/C competition events that will help spread the message about the positive values and benefits of R/C aeromodeling. Another such event may be taking off—Thorpe Engineering has created a nationwide "Starhawk Fun Fly" contest; competition will be in both Starhawk and non-Starhawk (open) categories. An August press release notes that prizes worth over $2,500 are being awarded at each such event, and winning pilots will qualify to compete at the Starhawk World Top Gun Challenge to be held during the Fourth of July week, 1992, in Las Vegas (only Starhawk models can compete there).

The two top contenders will engage in "aerial demolition combat competition between P4000C See-Op surveillance drone aircraft." The 12-foot, 100-pound planes will carry 16hp engines and onboard television cameras for in-the-cockpit pilot control. Thorpe is a manufacturer of both sport R/C and drone aircraft (e.g., McDonnell Douglas and Thorpe are cooperating on development of an 8-foot, rotor-wing R/C test vehicle). For more information on this new combat competition, contact Christine Everhardt at Thorpe Engineering Corp., 1715 E. Fairfield, Mesa, AZ 85203.

In our January issue, look for the finalists in our Second Great R/C Design Contest! We'll be choosing the winners and want your input! ■

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SUBSCRIPTION INQUIRIES: call 1-800-435-0715.

MODEL AIRPLANE NEWS (ISSN No. 0026-7295) is published monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. Connecticut. Editorial and Business Offices, 251 Danbury Rd., Wilton, CT 06897. Phone: 203-834-2900. FAX: 203-762-9803. Y.P. Johnson, President; G.E. DeFrancesco, Vice President; L.V. DeFrancesco, Secretary; Yvonne M. Micik, Treasurer. Second Class Postage Permit paid at Wilton, Connecticut, and additional Mailing Offices.
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AIRWAVES

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IN MEMORIAM

JOHN CLEMENS was a remarkable human being—a passionate modeler, a leader, a tireless worker, a naturally talented humorist, an ambassador for model aviation worldwide and a good friend to all. All of us owe something to this man.

John was an original, the likes of which we shall never see again, and now, he is gone. We are all diminished by his passing, but far richer for his time and achievements.

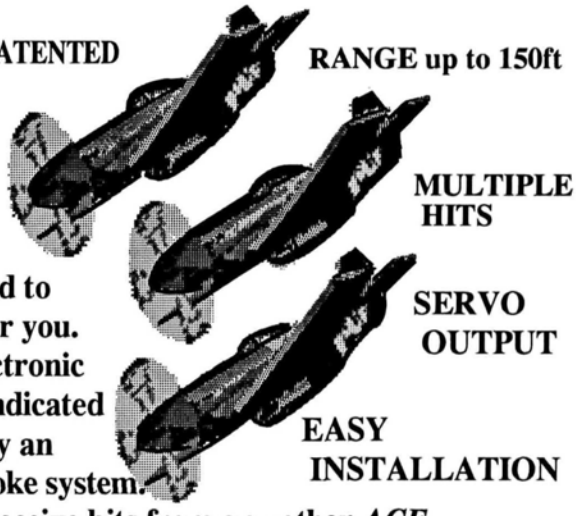
His record is well-known: an official at the Plymouth Internationals in the '50s, five-time Nationals contest director, 20 years service on the Nationals Executive Committee, 12 years as AMA vice president surrounding eight years as AMA president (1971 to 1978), 10 years with FAI as the U.S. voting delegate and chairman of the Subcommittee for Information and Education, AMA Fellow (1964), AMA Hall of Fame (1979), lifetime hobby-shop operator, and the Hobby Industry Association's "Man of the Year." John was recognized locally, nationally and internationally and, despite the fact that he originally hailed from Indianapolis, he was often referred to as the "biggest little Texan" because of his height. Though many kidded John with "short" jokes, he gave far more in return, and we all loved it!

I first became acquainted with him at the Atlanta Masters Tournament many years ago. We went to dinner. When he was serious, one could see he had a vision for AMA, for model

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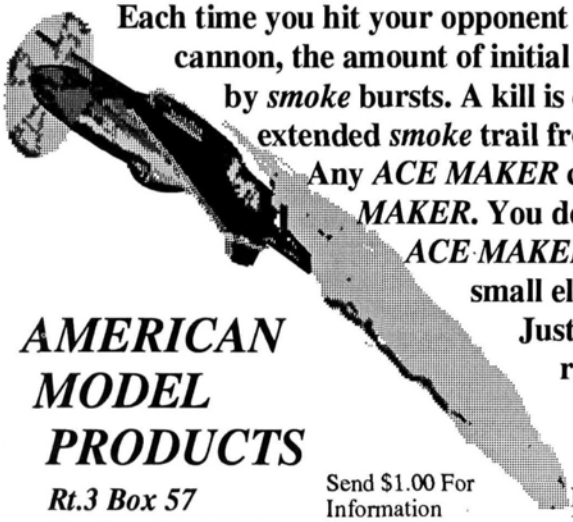
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aviation—even the museum was already more than a passing thought. But, I really remember the laughter; John was legendary for his ability to tell a joke. One-on-one he was even better. I doubt I finished the meal; it's difficult to eat and laugh at the same time. This dinner is an unforgettable memory. Many will most remember John as a humorist.

The last time I saw him, I had been through the same surgery he had experienced. He sensed my depression after the year-long health problem and, in 20 minutes, the man buoyed my spirits and allayed my fears. In 20 minutes, John Clemens helped because he cared, and caring was the hallmark of the little man with the big heart.

Well, Johnny, you're gone—we'll all miss you because we care. You showed us the way in more ways than one!

ART SCHROEDER



MYSTERY PLANE

I'm hoping you'll be able to help me out. Enclosed is a picture of a low-wing aircraft. Do you or any of your readers know the name of this airplane? This picture was taken sometime in the late '30s or early '40s at an airport in Olympia, WA. I'd like to build a 1/4-scale R/C model of this airplane, because it's quite different from most. I enjoy your magazine very much! Keep up the good work!

RICHARD LARSEN
Soulsbyville, CA

Richard, we feel at least one of our readers will have a strong hunch if not the definitive story on this plane, so look to this column for the answer in a future issue!

TA

1/2A EINDECKER

I'm 13 years old, and I live at a boarding school with my father where he teaches. There are tons of fields to fly from. Last summer, with the help of my father, I learned how to fly with a Sig Riser. He's been flying for 20 years. I've also built a GP Trainer 40 and a Sig 1/2A Hummer. I've made six successful solo flights, and I've dinged it twice. The Hummer is a real nerve-wracker.

Then I bought the July '91 issue of *Model Airplane News* and saw the Electric Eindecker article, the pull-out plans of the 1/2A Bee-

(Continued on page 10)

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AIRWAVES

tween, and I read about the author's problem of finding an "in-between" airplane. Could you help me find a 1/2A version of the E-111 Eindecker. Any help is welcome. I love the magazine; don't change a thing. Thanks again.

JAMIE CLARD
Kents Hill, ME

Jamie, it sounds as if you're off to a great start in the R/C hobby. Spending time with your dad at the flying field is a great way to spend the summer as well as to strengthen the father/son team. There are a couple of 1/2A-size Eindeckers on the market for you to choose from. The first is an electric E-III from Davey Systems Corp. that could easily be converted to glow power. The other way would be to scratch-build the 33-inch-wingspan version of the Eindecker that Bob Holman Plans has to offer. The Davey Systems are easier to build, but the Holman plans offer more scale accuracy. It's up to you how you become the "hun in the sun"! Here are the addresses of the companies I've mentioned: Davey Systems Corp., 675 Tower Ln., West Chester, PA 19380; (215) 430-8645; Bob Holman Plans, P.O. Box 741, San Bernadino, CA 92402; (714) 885-3959. GY

PERPLEXING POWER

I've only been flying R/Cs for a few years, and I'm still confused by how to properly power a craft. I built the beautiful Hobbico ASAP Extra 300 with 55 3/4-inch span, and it weighs about 6 to 6 1/2 pounds. The power recommended was .40 to .46 2-stroke or .60 to .91 4-stroke. The .40 to .46 2-stroke sounds way too little for this kind of weight. Is it?

Could I put a Super Tigre S-90K Ring or a World ASP .91 2-stroke on it? How about a Hobby Shack EZ F-16 Falcon ARF with a Fox .40 ABC BB? Too much?

See what I mean? Is there a chart somewhere that will tell the correct power, and is there a trade-off chart for engines, i.e., a .90 4-stroke will power craft that use up to a .60 2-stroke, etc.

A lot of questions, I know, but I doubt if I'm the only confused one out here! Thanks for your time. Great mag!

DANIEL A. BULLARD
Las Cruses, NM

Dave, you can put any engine in any airplane just to see what will happen. Years ago, my flying buddies and I used to over-power planes in the name of science; more often than not, the research was short-lived. There's a lot more to the equation than just the model's weight. Things like airfoil, lift, drag and wing loading all come into play in the final power requirements.

For example: a pylon racer that weighs in at 6 1/2 pounds with 450 square inches of thin "airfoiled" wing area needs a super-high-performance .40 racing engine screaming at over 20,000rpm to make it perform as it should. Conversely, a 95-inch-span Hobby Lobby Senior Telemaster with 1,330 square inches of high-lift, turbulated airfoil will fly on a strong sport .40! It won't be exciting, but it will definitely fly around. With a .60 2-stroke or a .90 4-stroke, the Telemaster will be a lot of fun.

Your .91 2-stroke-powered Extra 300 will be a nose-heavy rocket, while your Fox .40 ABC BB 2-stroke-powered F-16 will be a tail-heavy rocket that's probably pushing the ragged edge in terms of wing loading—a simply superlative combination for a nerve-wracking day at the flying field! (or a very short one).

When you move from a 2-stroke to

4-stroke, move up one or two sizes, depending on the model in question. For example: when a .40 to .46 2-stroke is called for, use a .60 to .90 4-stroke. When a .60 2-stroke is called for, move to a .90 to 1.20 4-stroke. Other than that, there's no chart to guide you "across the aerodynamic board" that will help you choose an engine for any design.

Wait a minute! I'm wrong! There's a chart, and it's found on the side of every kit box. Designer/manufacturers spend a lot of time and money testing to determine the best power match for their kit offerings. They're not trying to trick us; they wish us success so we'll buy more of their products. These spec charts are derived with optimum performance in mind; use them. CC



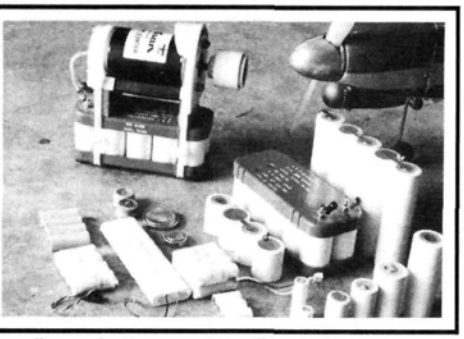
MODELING MEMORIES

I'm looking forward to the December '91 issue of *Model Airplane News*. It was from the December '41 issue that I built the tow-line glider. I believe it was called "The Cloud Coaster," a 48-inch polyhedral model with a fuselage built on a crutch. The fuselage was planked with 1/8-inch soft balsa. It took me approximately two years to build this model, and I lost it on its second flight.

I've been building models

(Continued on page 65)

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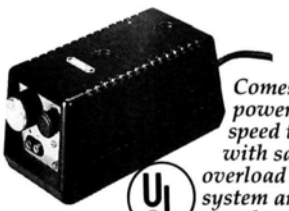
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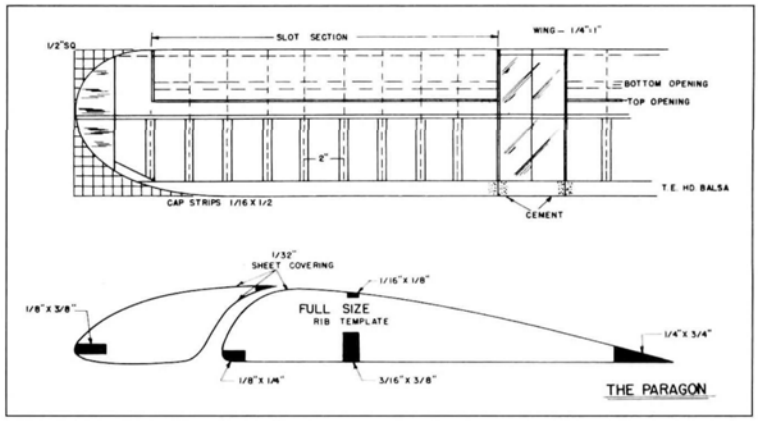
BRITAIN'S BIG BERTHA

by GERRY YARRISH

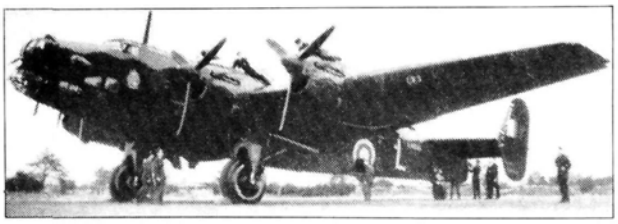


AS THE December 1941 issue circulated, little did readers realize that the country would soon be plunged into war with Japan. (Pearl Harbor was bombed on December 7, 1941.) A shakeup was about to occur in U.S. aviation as hostilities increased, and this would also impact the modeling world. Future editions of this column will track these developments.

England's Handley-Page Halifax heavy bomber was on the December 1941 cover of *Model Airplane News*. Dubbed "Big Bertha" in the U.S., it was a monster of a plane with its four 1,300hp engines, twin tails and a tail-gunner turret. It was 70 feet, 9 inches long, 22 feet tall, and it had a wingspan of 99 1/3 feet. The Halifax's lineage can be traced back to the Handley-Page 0/400, and it was highly successful in laying waste to enemy cities and manufacturing sites. It was constructed with materials that included steel tube, aluminum sheet and formers, wooden formers, skins and stringers, and a linen covering. These traditional British construction methods had little in common with our own fabrication ideas (e.g., all-metal, monocoupe designs, such as the B-17 and the B-25), but the Halifax was every bit as tough and durable as our own bombers.



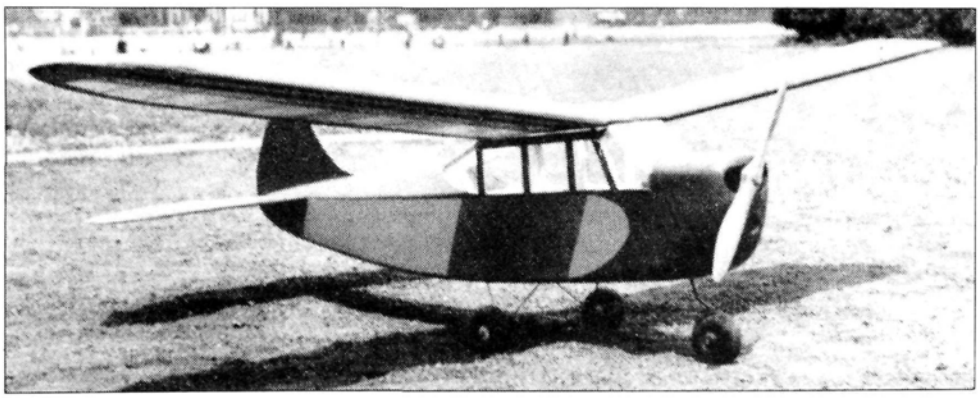
Here's a cross section and a top view of the Paragon's wing.



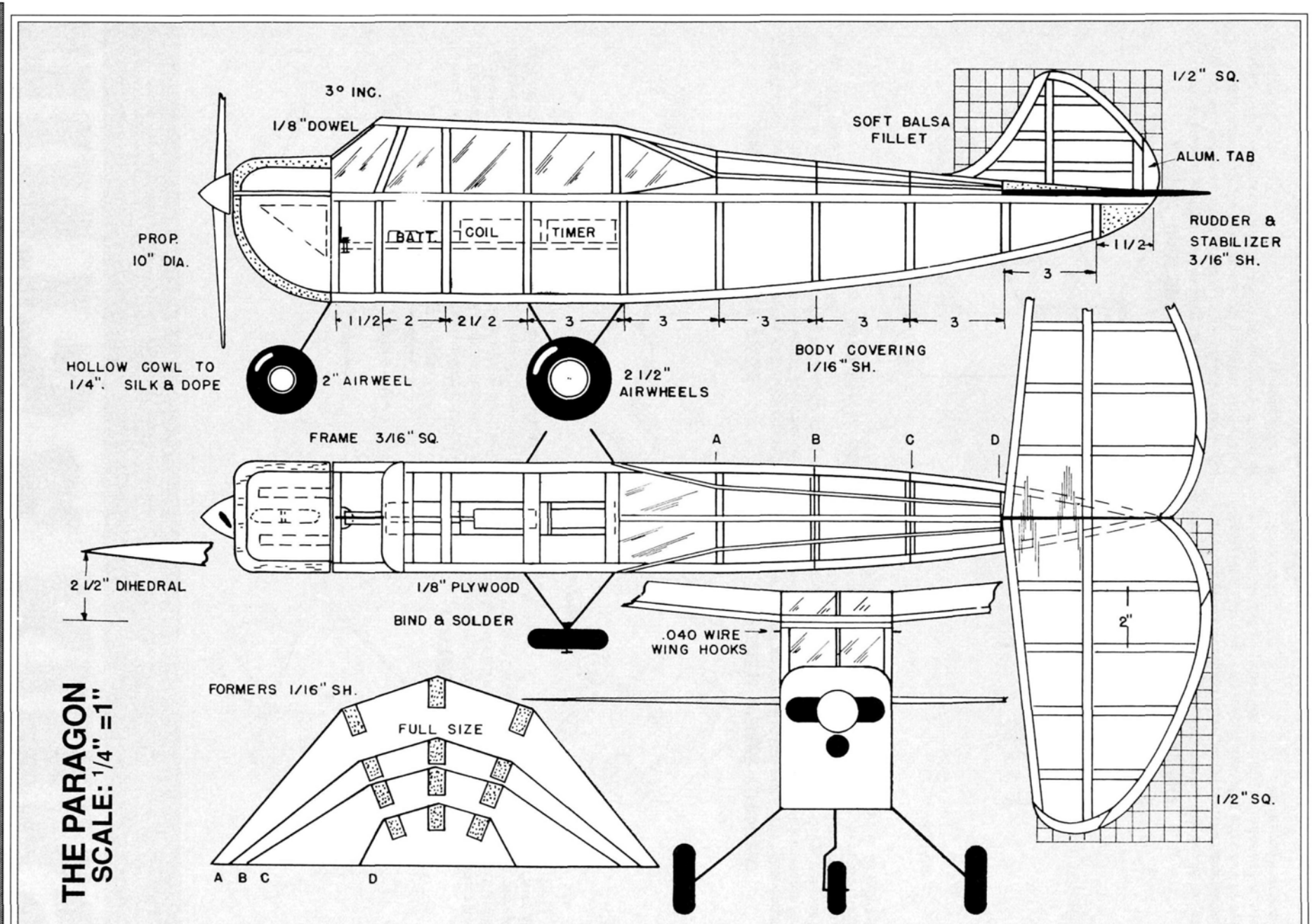
Wings of retribution! The Handley-Page Halifax, with its 99-foot span, is being serviced so it can deliver yet another pounding to the enemy.

ON SLOTTED WINGS

The Paragon, a cabin-wing, gas-powered, free-flight design was also featured in the issue. It had an advanced wing treatment that included a fully slotted wing. Designed by Frank Ehling, the model had a wingspan of 48 inches, a chord of 7 5/8 inches, and the upper slot exit was 2 1/2 inches aft of the leading edge. With its traditional stick-and-former construction and trike landing gear, the Paragon would make a good R/C old-timer model. Shown here is the drawing of the Paragon as it appeared 50 years ago. Perhaps some modern versions of the Paragon will soon take wing. ■



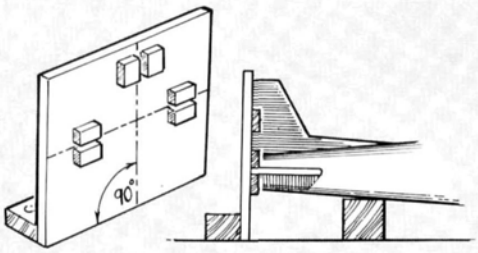
The Paragon could well have been the first gas-powered model to have fully slotted wings, adding great efficiency and stability—much appreciated qualities in free-flight days.


3° INC.
1/8" DOWEL
1/2" SQ.
SOFT BALSA FILLET
ALUM. TAB
PROP. 10" DIA.
BATT.
COIL
TIMER
RUDDER & STABILIZER 3/16" SH.
1 1/2
3
1 1/2
2
2 1/2
3
3
3
3
3
3
HOLLOW COWL TO 1/4". SILK & DOPE
2" AIRWEEL
2 1/2" AIRWHEELS
BODY COVERING 1/16" SH.
FRAME 3/16" SQ.
A
B
C
D
2 1/2" DIHEDRAL
1/8" PLYWOOD
BIND & SOLDER
.040 WIRE WING HOOKS
2"
FORMERS 1/16" SH.
FULL SIZE
A B C
D
1/2" SQ.
THE PARAGON
SCALE: 1/4" =1"

HINTS & KINKS

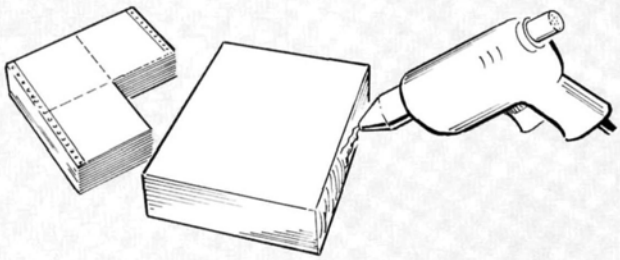
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

by JIM NEWMAN



TAIL ALIGNMENT JIG

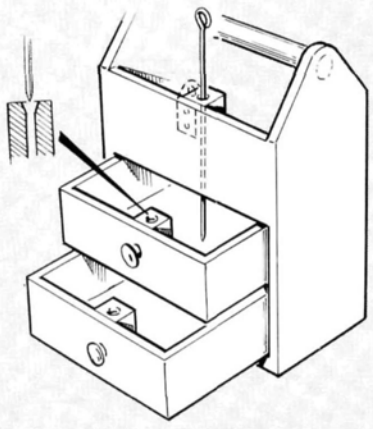
This board, screwed to the bench, should help to square-up tail surfaces during assembly. Use a square to draw a vertical line up from the bench, and make sure the horizontal line is at 90 degrees to that line. Back the model up to the jig, block it level left to right and fore and aft, then attach the tail surfaces, which will be supported by the small blocks while the glue dries. *Roger DiLuigi, Homewood, IL*



HIGH-TECH EPOXY PADS

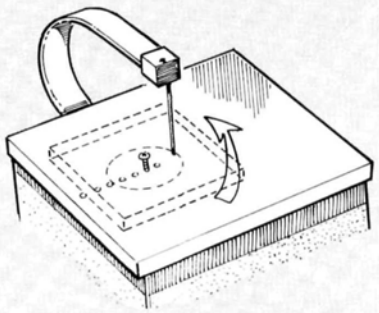
Nowadays, almost everybody has access to old computer printouts. Just remove the perforated margins, then saw the paper stack into four sections. To bind the sheets into a note pad, use a stick to spread hot-melt glue along one side. After mixing the epoxy, tear off the soiled sheet to expose a clean one.

Bob Earp, Surrey, BC, Canada



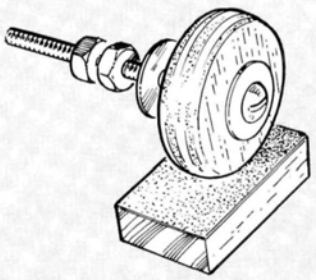
FLIGHT-BOX SECURITY

To prevent the drawers of your field box from sliding out when you carry it to the flying field, glue wooden blocks to the inside of the tray and to the inside of each drawer. Drill holes through the blocks, the tray and the drawers. Drop a lockpin through the holes, and secure your box with a padlock by installing a sheet-metal tab (shown dotted). *Vic Gillette, Hobart, IN*



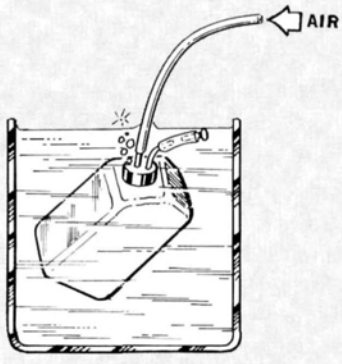
CUTTING TRUE CIRCLES

Drill a series of closely spaced holes across your saw table, and tap a thread in each, if desired. Drill a small hole in the appropriate-size wooden square, press a machine screw through it, then insert it into one of the holes. Slowly rotate the wood against the running blade . *José Claudio Villar, Paraná, Brazil*



WOODEN WHEEL TURNING

Wooden wheels are light and work well on small models. Many vintage designs use them. Laminate layers of balsa to the desired thickness, then insert and glue a metal tube bushing through its center. Mount a machine screw with large washers on each side, and secure it with a nut and a locknut. Spin the balsa at medium speed in a drill, and apply it to a sanding block. Applaud this contributor; he has been a faithful reader since 1935. *Carlos Ortiz, Romero, Co. Del Valle, Mexico*



TANK TESTING

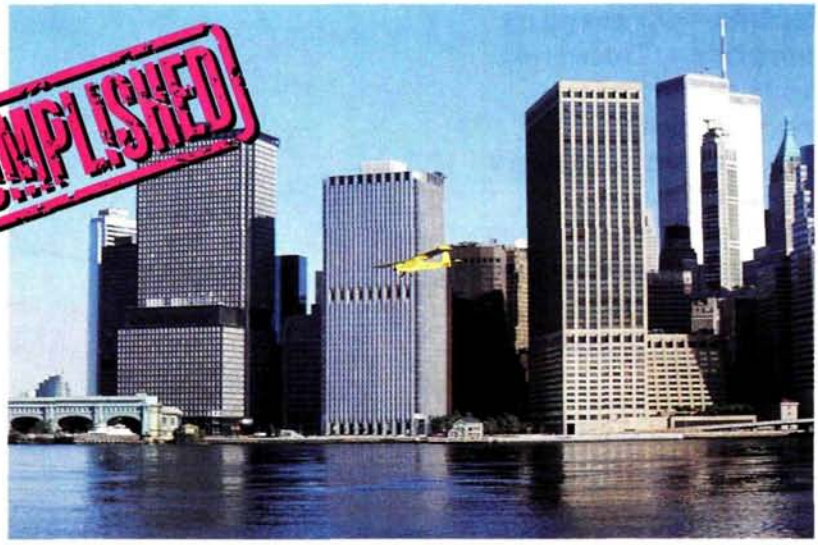
Here's how to detect leaks *before* you install your fuel tank: plug the vent with a short piece of fuel line and a dowel or a rivet, then pressurize the submerged tank by blowing into it, or by using a cycle pump. Bubbles coming from around the stopper or the brass tubes indicate a serious leak, which must be fixed before fuel contaminates your radio. *Bob Peterson, Youngstown, NY*

AIR SCOOP

by CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find news that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

MANHATTAN MISSION



After a two-year practice/planning period, Angelo Lanci can be proud of his "Project Manhattan" team for successfully circling Manhattan Island with a Zenoah-23-powered, Futaba-guided, Hobby Lobby Senior Telemaster. With chase boats, copilots, frequency monitors and communications all in sync, (including 15 transmitter-to-transmitter "hand-offs") the 8-foot-span, yellow bird gracefully departed and touched down on the predesignated defunct pier (somewhere on the Brooklyn waterfront) in 103 minutes—just 8 minutes behind schedule! Had it not been for an old swing bridge that was stuck in place and too low for the chase boats, the plane would have come in 2 minutes ahead of schedule. Tom "Flying Circus" Atwood will have a full report in the January issue.



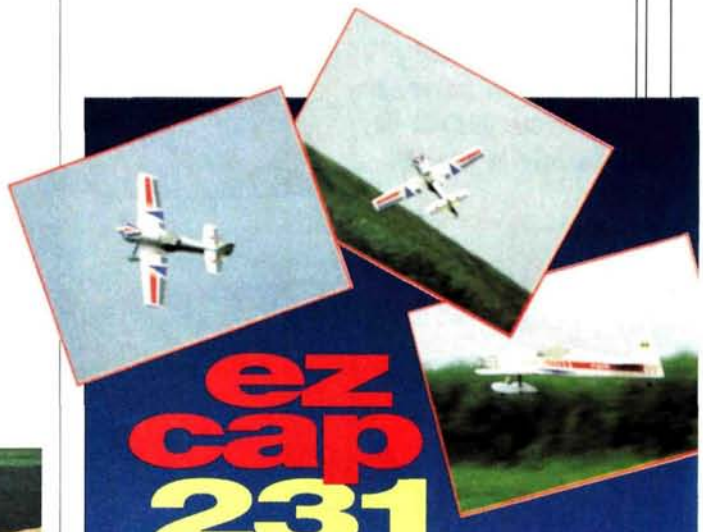


Electric Brew

Here's an extremely ambitious Japanese project. This 114-inch-span C-130 scratch-built monster uses four Tamiya Dynatech 540-size motors. Each swings an 11x6 prop by means of gear reduction. All of this is motivated by 28 cells. But the question is, "What is it covered with?" Give



up? Aluminum from no less than 170 beer cans, anchored with more than 700 screws! Evidently, the plane flies well, and it only weighs 17.9 pounds. Be sure to use Bud Lite cans; they weight less!



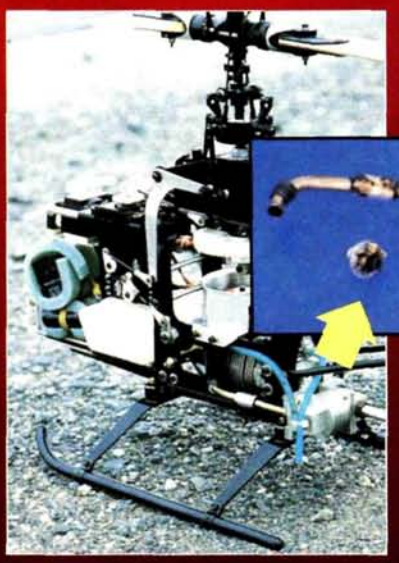
ez cap 231

Here's the latest from Sports Aviation's assembly line in Japan—a 57-inch-wingspan CAP 231. The model is for .40 to .45 2-stroke and .80 to.90

4-Stroke Heli with Super-Charging Super Silencer



This Shuttle uses an O.S. 48 4-stroke that has a cooling shroud with a fan. The hand-machine pulse-turbine that's attached to the exhaust pipe increases mid-range torque and keeps the engine super quiet, all while it delivers more pressure to the fuel tank. Little else is known about this experimental project, but I haven't given up yet.





Silent Cobra



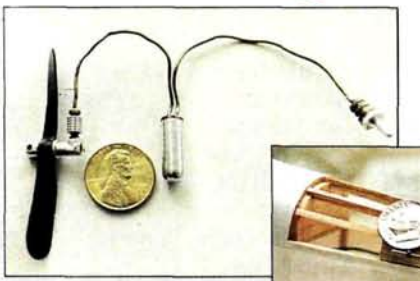
The Kalt Baron Whisper is being touted by many heli experts as "the best" electric helicopter around. Hobby Dynamics must be selling it successfully because, starting with the TOW Cobra, Kalt is introducing other scale bodies that will fit on Whisper frames.

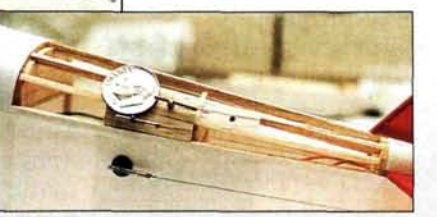
4-stroke engines. It features the original-design triple-layer skin over an inner balsa/ply skeleton. In this photo, which was taken in Japan, the prototype is being put through its paces.

Dr. Invento is at it again



Russ "Dr. Invento" Pribanic (the guy who's building the Harrier with vectoring nozzles; see the March '91 issue), must get very little sleep. Here, the Doctor has equipped a Hunt Models 21-inch-span Fly Baby I-B with a device that moves its control surfaces without servos, motors, or solenoids. Instead, it has a nickel-titanium, shape-memory-alloy (SMA) wire that changes in length when electrically charged. It's called BioMetal (Nitinol) wire, and it's available from Mondo-tronics in Sunnyvale, CA (tel: 408-734-9877). The spring-loaded wire system is energized by modified servo amps that provide varying degrees of voltage, thereby providing proportional movement. According to the doctor, the concept needs more R&D. We'll be watching!





We aren't the only ones watching the Doc. His scratch-built CO-2 engine (not in the Fly Baby) is another ongoing project. It has a .06 bore and .06 stroke, for a .00017ci (2.65cmm) displacement—the smallest engine in the world; or so he thought! Stefan Gasparin, Czechoslovakia's own Inspector Gadget, has apparently been hovering his spy satellite over the Pribanic home. He has developed an engine that's even smaller. The Doctor is mad, but he's not finished!

GIANT STEPS

TO SCALE OR NOT TO SCALE?

by DICK PHILLIPS

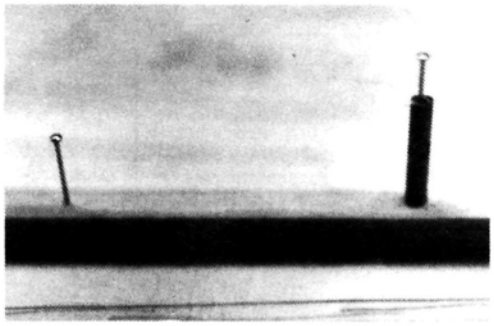
SOME MODELERS who are addicted to scale modeling tend to be a little snobbish about their part of the hobby. I may have conveyed such an attitude in past columns, but it just ain't so. During the many years that I've been involved in the hobby (including one when I was attached to submarines!), I've built everything from small rubber-powered models to gliders.

I'm convinced that most so-called sport builders want their models to look *something* like a real airplane, so they, too, lean a little toward scale. There are many types of scale aircraft—from museum-quality models to stand-way-off scale—and not all of them are built for competition. Often, however, models turn out well and their builders are tempted to enter them in local or regional scale contests. *That's* when the scale bug bites.

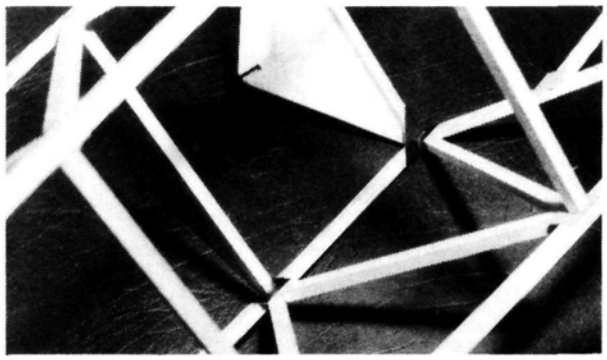
Those of us who are interested in scale modeling, competitive or not, shouldn't be snobs about it. We're a large body of individuals, and we all have different tastes. So, if I've given the impression that I'm a scale snob, it was unintentional. In fact, I believe that one of the reasons the IMAA has been so successful and grown so rapidly is that its rules allow non-scale models (as opposed to the QSAA rules, which permit the models to have only minor deviations from true scale).

LONG-TERM INVOLVEMENT

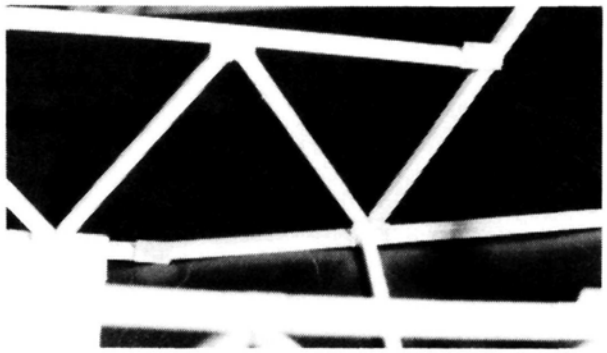
Having written a column similar to this one for more than 16 years, I find that there's only so much *really* new information available to give you. I realize that there are more and more of you building large models, so I'll repeat some topics. Also, many of the procedures and practices that I've developed over the years apply equally well to the building of small models. During the next few months (that's the building season for those of us who experience winter), I'll cover some ground that I've covered in the past. I hope that it will help some of you build easier, better and faster.



A short piece of brass tube makes it easy to drive pins through spruce longerons (see text).



Adding gussets will increase the glued area significantly.



Fuselage joints reinforced with gusset plates are much stronger than butt joints alone.

CONSTRUCTION

Whenever I build a model, large or not, I try to increase its strength above and beyond what the designer intended. That's not to suggest that model designers don't design good models—far from it! Most of the designs that I've seen are well-planned and well-executed. I just like to ensure that my models are as strong, reliable and durable as I can make them. The changes aren't usually very dramatic; they have more to do with construction detail more than anything else. The little time it takes me to make them results in models that survive longer and perform better (even when flown from rough fields) than the unaltered planes would have. You may find some of my changes interesting, and they're inexpensive and easy to incorporate into your building practices.

For example, I use spruce longerons, spars and load-bearing members. I believe the added strength of spruce is worth the minor weight gain involved. Most large

models are generously powered, so a slight weight increase doesn't have the same significance that it might have in smaller models.

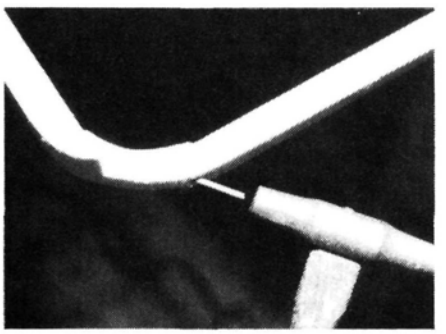
I've used woods other than spruce; boxwood, pattern pine and even cedar lend themselves to our use. You may be surprised at the availability of woods suitable for model building. I once built a 1/4-scale Mr. Mulligan with poplar strip stock that I stumbled on through a friend in the lumber business. Poplar is soft (although it's much harder than balsa), and its long grain allows it to be bent sharply without breaking.

I buy spruce boards and cut my own stick stock from them. It's economical, and I can produce whatever oddball sizes are called for by the designer. (For more information on that process, please refer to my column in the October issue).

Once you have the necessary material, there remains the problem of holding the wood in place. Usually, you can pin your material over the plans with straight pins that you push through the wood easily with your fingers or with a light hammer tap. Spruce is harder than balsa, and it isn't quite as easy to fasten in place. I've come up with a solution. I cut a small length of brass tube, shorter than the pin by the thickness of the material I'm using. I place a pin inside the tube and drive the pin through the material. Then, I remove the pin from the wood, take it out of the tube and drive the pin back into the hole.

After I pin the strip stock into place, I usually add gussets to the joints in the basic fuselage structure. I'm a pack rat; an inventory of my shop would reveal a large supply of miscellaneous materials. Although I may never use them, I have them if I ever need them! Among the useful things in my collection are cuttings and ends of 1/32- and 1/64-inch-thick plywood, and I use this material to make gussets. Cut triangular gussets square on one corner, and then glue them into place. Using Hot Stuff or a similar adhesive allows me to lay a bead of glue on the fuselage members, then hold the gussets in place momentarily while the glue sets. Next, sand the gussets lightly to shape them to the contours of the fuselage.

Using gussets will increase the glued area dramatically, and they'll make the fuselage more rigid and the joints more stable. After I join the two sides of the fuselage, I usually add gussets to the cross-members as well. Cross-braces inside a fuselage often interfere with control-rod placement, and they're easy to eliminate using thin plywood gussets on the cross-members.



A toothpick dowel, tapped into a drilled hole, strengthens the joint considerably.

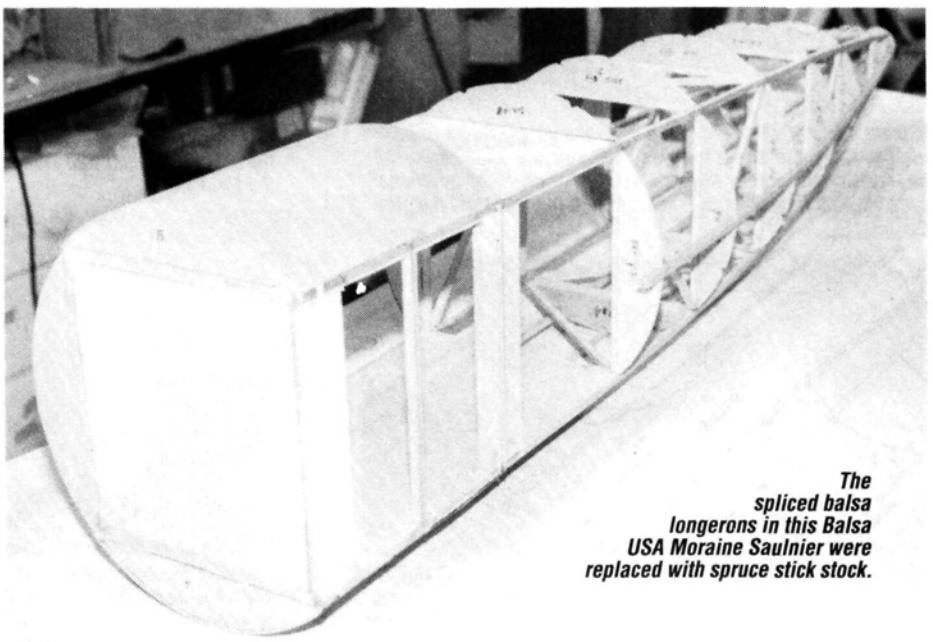
Gussets increase the plane's weight slightly, but, even in most smaller models, the increase is negligible. In some models, it may be possible to use small stick material if you substitute spruce for balsa and install gussets. The net weight change could even be to your benefit!

CHANGES

Don't hesitate to make alterations to plans or kits. I'm not suggesting that you make changes for the sake of change, but if you're used to certain construction methods and want to incorporate them into a project, there's no reason why you shouldn't. Just make sure that the changes don't compromise the model's structural integrity.

FINAL NOTE

Anyone who can provide me with a current address for Behren's Plan Service, or an address for Mr. Behren (formerly located in Far Rockaway, NY) would certainly earn my gratitude. If you can help, please drop me a line in care of this magazine. ■



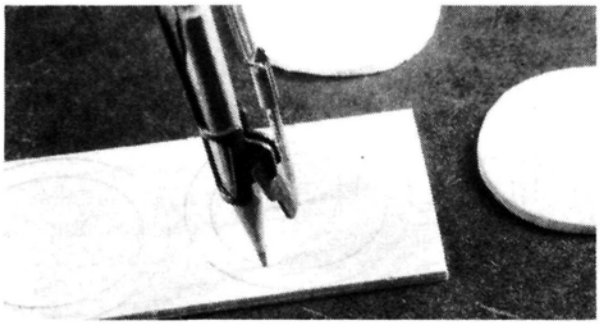
The spliced balsa longerons in this Balsa USA Moraine Saulnier were replaced with spruce stick stock.

HOW TO:

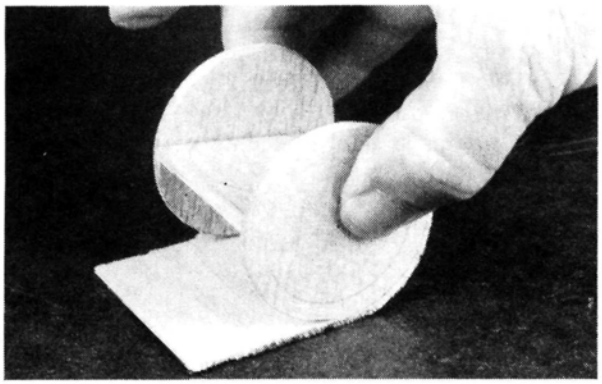
by RANDY RANDOLPH

MAKE LIGHT BALSA COWLS

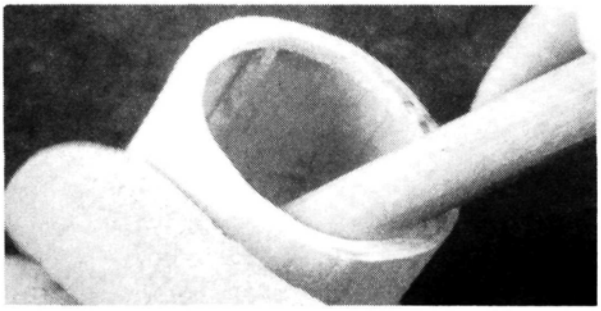
Most kits feature "cowled-in" motors (or engines) that give the finished airplane a smooth, streamlined look. Scratch-builders, however, are left to their own devices to build a cowl that suits their design. Here's a way to build light, removable cowls that fit almost any firewall/motor combination.



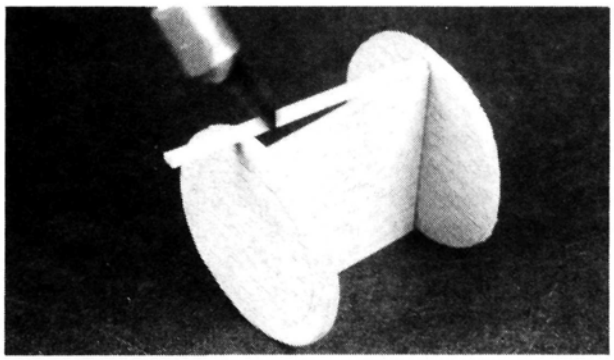
1. The cowl consists of a "crutch" and two formers. Allowing for the thickness of the balsa sheet that you'll add later, make one former in the shape of the firewall and the other in the shape of the front of the motor. Draw a reference line about 1/8 inch in from the edge of each former to facilitate cutting them from the finished cowl.



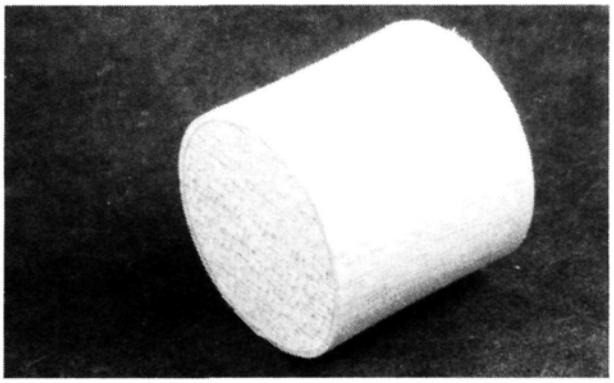
3. Glue a piece of sheet balsa to one of the strips. Run a bead of thick CA along the sheet's edges, and roll the sheet onto the formers. (On odd-shaped formers, you can "butt-glue" additional pieces of sheet in place as needed.) Hold it in place until the glue sets.



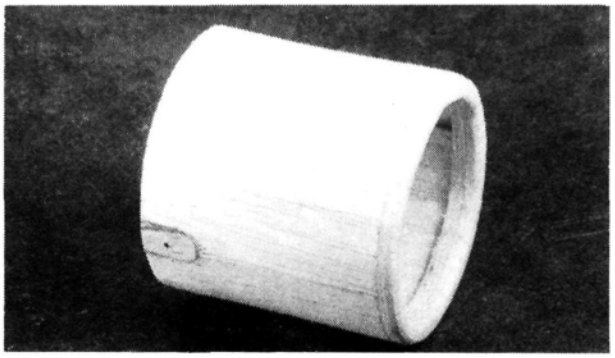
5. Cut the formers' centers out along the reference lines, and remove the crutch. It should slip out of the cowl easily, but you can use long-nose pliers to remove any material that sticks to the sheet. Smooth the formers' inside edges with sandpaper.



2. Join the formers with a sheet-balsa crutch that you've cut to the appropriate length for your motor assembly. Glue a 1/16x1/8-inch balsa strip along each side of the crutch, flush with the formers. Attach the strips to the formers—not the crutch—so that you'll be able to remove the crutch from the finished cowl.



4. The strips along the crutch reinforce the finished cowl. When the sheet is in place and the CA has dried, trim the sheet flush with the formers.



6. Here's the completed cowl. A balsa ring was added to its front, and a 1/16-inch plywood insert was added to its rear so that it could be screwed to brackets on the firewall. You can use a Dremel tool to make cutouts in the cowl's rear so that it will accept your motor.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING!

SEND IN YOUR SNAPSHOTS!

MAN is your magazine and we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1991. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

■ HOUSE OF BALSA F-82?



No, House of Balsa doesn't make a twin Mustang, but Scott Fuller of Ridgecrest, CA, used its P-51 kits to fabricate this F-82 night-fighter. He increased the wingspan with an 18-inch constant-cord center section, and he made the horizontal stab out of sheet balsa. The outboard wing sections and fuselages are all parts from the kits. Scott increased the vertical area by about 25 percent, and he says that the O.S. 25FP-powered twin is "considerably over-powered and would probably fly fine with .15s." The twin 'stang has light wing loading and good slow-speed qualities, and it displays excellent ground handling with its wide stance. Scott maintains that the F-82 has very good single-engine performance, probably owing to the close-in engines.

■ TWIN CADET



Charles E. Kutsch of Shelocta, PA, poses proudly with his latest creation—a twin conversion from a Sig Cadet Senior kit. The "Shuttle," as Charles has named it, is powered by two Saito .40s that swing 11x7.5 Master Airscrew props, and it's guided by an Expert 4-channel FM radio. According to Charles, the Shuttle flies beautifully and will climb with one engine out, but we have our doubts, considering the mild-natured Saito .40. The model is very interesting, however, and it has had an impressively long life for a twin: it has been flying since January 3, 1988! This clean twin won a Best-In-Sport trophy at a local meet.



■ SPEED TRAP

Direct from Englewood, FL, comes Ed McCollough's 87mph Proba, powered by a Russian MAC .40! Ed knows that the model does 87mph, not 86 or 88, because his flying buddy, a sheriff, clocks it with the radar gun during full-speed low passes. (We wish that's all they'd use those things for!) Anyway, the 54-inch-span pusher does all the "tricks" except the knife edge. Ed says that although the Proba is very fast and "hot to land," it's "rock-steady" and has no tip-stall tendencies. We think that it's a clean and pretty creation. So, Ed, did your buddy give you a ticket?



■ PASTEL PERFECT

Here's Bruce Jennings, of White Hall, MD, with his mint green and blueberry mist, 88-inch-span, giant-scale Vailly Sport. The plane was built from plans offered by Vailly Aviation of Farmingville, NY, and, all kidding aside, we think that this scheme is *very* original and *super* eye-catching. Bruce sprayed Benjamin Moore High-Gloss latex over Super Coverite; he uses a gas-burning Quadra 50, so that doesn't present a problem! Construction time on this 22-pound model was nine months—time well spent, Bruce!

■ GREAT LAKES FOUND IN ENGLAND

Jim Horne of Reading Berks, England, photographed his beautiful 1/4-scale, 80-inch-span, scratch-built Great Lakes Special on a "typically British summer day" at Middle Wallop, the home of the British Army Air Corp. Powered by a 36cc Kawasaki, this big bipe is extremely aerobatic, and it doesn't have any bad habits, according to Jim. We think he did a simply splendid job on his Great Lakes, and he's not too bad with a camera, either, considering the overcast conditions and the limited light in which he had to work. Then again, we suspect that's second nature to the Brits!





■ MAIDEN FLIGHT

Here's Bill Novak's 58 3/4-inch-span PZL 11c, right after its test flight. Bill, of Centereach, NY, built the Polish fighter from very old *Model Airplane News* three-view drawings by B. Karlstrom. The plane is all balsa, spruce and ply,it's powered by a geared-down K&B .45, and its silk-and-dope finish was done in a 121 Squadron, 2nd Air Regiment (Krakow) color scheme. This all adds up to a very respectable 5 1/2-pound dry weight. Little else needs to be said about this model; the picture tells the story better than words ever could. This has obviously been a very special project, with "pride-giving" results.

■ DIRECT FROM FRANK'S FLYING MACHINE FACTORY



Hurry, hurry; step right up ladies and gentlemen, and witness a flying wonder of the world! A most amazing, glider-toting, Cannon-Snappy-Q-camera-carrying, air-braking, fully-flapped, three-finned contraption that's responsible for causing the fliers in Carlsbad, NM, to have a lot of fun. The 89-inch-span "Big Bird" is based on a stretched Cadet fuselage and uses a Fox .78 to haul its 13 1/2 pounds (plus its secret cargo) aloft. We just hope that Frank doesn't over-shrink the plane's MonoKote when he flies it through those hoops of fire.



AIRPLANE FACTORY

KOMBAT 40

by TOM ATWOOD

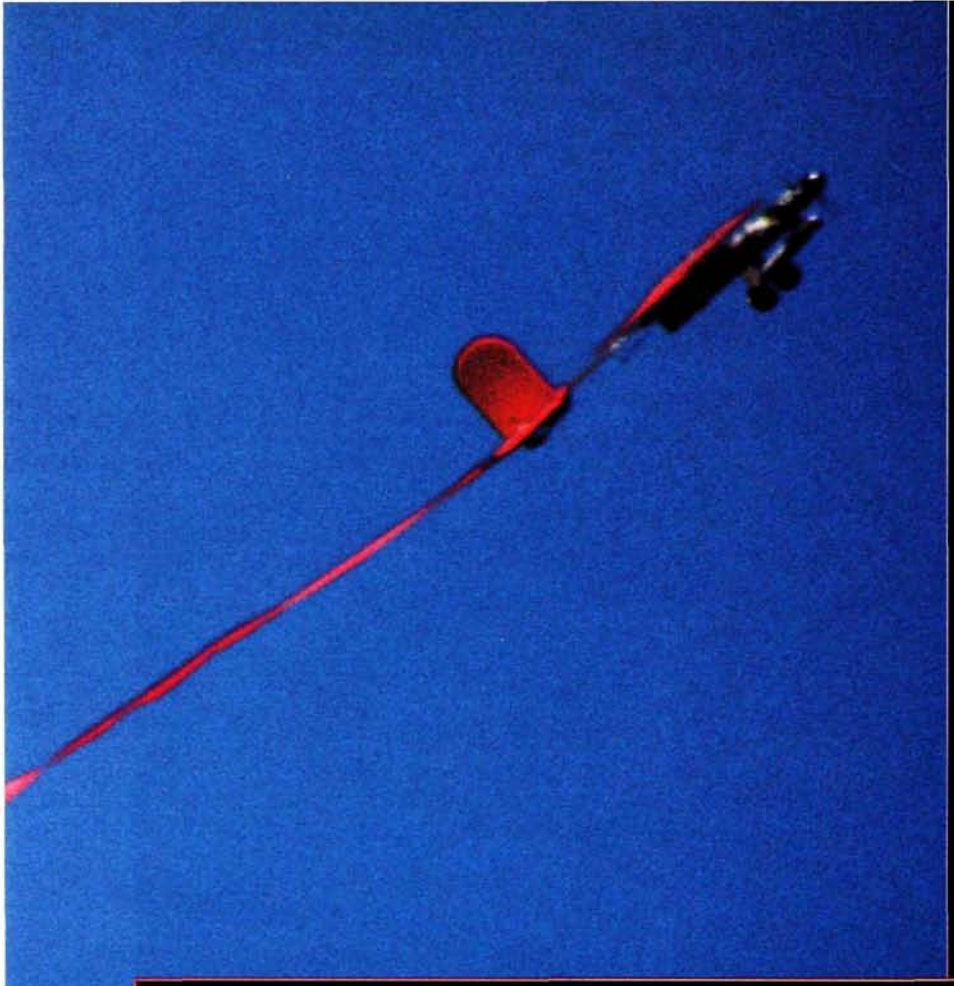
THE KOMBAT 40, one of Airplane Factory's* "Airmadillo" series, is an appropriately mad neuverable, almost indestructible, bolt-together airplane, the sole mission of which is to gain air supremacy at the R/C flying field. This model has the simple, rugged qualities of a piece of military equipment. To have one in front of you is to be posed with two unavoidable questions: how good a flier are you, and when are you going to prove it?

War machine!

ASSEMBLY

We received two planes from the Airplane Factory: a preproduction prototype and a full-fledged Kombat 40 production model. These no-frill, all-utility planes have rugged, extruded, rubberized plastic wings that bolt onto a hollow aluminum frame that serves as the fuselage. Oak reinforcement inserts are seated in key locations where components are bolted to the frame. The radio receiver and the battery are nested in a fuel tank (one end has been cut off) that's lodged between the two beams that compose the forward part of the fuselage. Plas

(continued on page 33)





TIPS FROM ON TOP

To really check out the Kombat 40, we needed a couple of "pros" to wring these planes out in the air. David Baron, the recent 5th-place winner at the Huntsville Fun Fly Nats, and Rolly Siemonsen, who's president of the Kingston Radio Control Modelers Club of Kingston, Ontario, and who has placed 1st in combat competition at Rhinebeck several times over the last 15 years, volunteered for the assignment.



David Baron (left) and Rolly Siemonsen hold the Kombat 40 and the prototype after a midair collision.

After an initial trim-check flight, Dave landed the plane, increased the elevator and rudder throws and attached a 30-foot streamer made from surveyor's ribbon. Although the rules vary, the object of combat competition is to cut through a 10-meter ribbon that trails behind your opponent's plane.

As the plane jumped back into the air, Dave observed that the load of the streamer slowed the Kombat 40 down a little. Rolly attached a streamer to the prototype, went airborne, and the dogfight began. After a couple of refuelings and a total flight time of 15 to 20 minutes, a heavy mid-air collision occurred. The prototype came tumbling down. Under Dave's guidance, the Kombat 40 limped in with rudder and elevator control only. Its wing was skewed about 25 degrees by the force of the impact, which broke the aileron servo output arm.

How did they fly?—the planes tore up the sky in a wide variety of aerobatic combat maneuvers. Dave advised us that the rudder must be used judiciously to get the most out of the Kombat 40. "A little bit of rudder aileron coupling will probably go a long way in pure combat. Flying it on just aileron and elevator would result in getting caught in a stall after a while. There are times when you're close to a stall when you wouldn't want to use the ailerons at all." He continued that it's mandatory to keep air flowing over the control surfaces at a good clip (the directions say to land it under power). Rolly noted that he was using both rudder and ailerons together and that "it seemed to work very well."

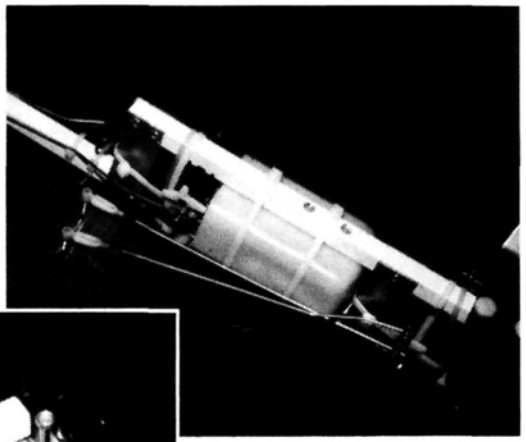
PHOTOS BY TOM ATKINSON AND YAMIL SUED

(Continued from page 28)

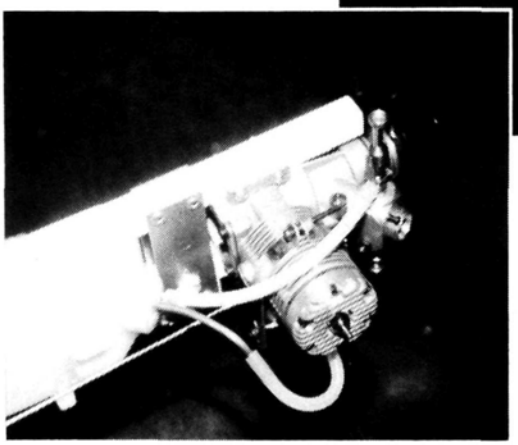
tic tie-wraps hold the radio compartment and the servos in place. There was no vibration protection for the servos in our review kits, but the focus here is on simple construction techniques and on components that can easily be replaced. *[Editor's note: Kombat 40s now come with foam tape to protect the servos from vibration.]* The instructions indicate that you can build the plane in about an hour. I loafed along and took about three.

The strip ailerons on the Kombat 40 are an integral part of the extruded plastic wing. Wire servo-linkages are exposed; in fact, everything but the radio is exposed. To keep these components clean, I covered the servos and the radio compartment with a plastic bag.

I installed an Irvine .40 with a tuned pipe in the prototype. Associate editor Gerry Yarrish installed a Webra Speed .40 on the Kombat 40. The engine is mounted after drilling holes in the two beams at the front of the fuselage/frame. Gerry put a wooden plug into the bottom beam, which, on the Kombat 40, was hollow. Nylon bolts are supplied to mount the wing and landing gear. The construction is just that simple.



The radio compartment was a fuel tank with one end cut off.



A Webra Speed .40 was mounted on the Kombat 40.

We chose to use the JR* Max 4 FM radio in the Kombat 40. It's an inexpensive 4-channel radio (available at the discounted price of $130 to $140; the AM version is available at the discounted price of approximately $110). The radio includes a narrow-band receiver, three standard-size NES-507 servos and a 550mAh receiver battery pack.

SHAKEDOWN FLIGHTS

After a standard textbook liftoff, I quickly realized that my 1-inch aileron throw (the directions recommended 3/4 inch as a starting point) made the plane a little too sensitive for my liking. While the plane circled in preparation for a landing, an embankment at the far end of the field, apparently aware that the flight was being videotaped, jumped up and snatched the plane out of the air. Damage? The nylon bolts were sheared off the wing and the landing gear; one aileron linkage wire was slightly bent; and the wooden prop was broken. Whereas nearly any other plane would have been demolished, I repaired this one in about 5 minutes.

Gerry commented on his first flight of the Kombat 40: "I found the plane positive and predictable in its response. I landed twice dead stick (the second time because of a forward-jammed clunk) and, for a plane that looked a little on the heavy side, it had a pretty fair glide. Although the directions suggest that you can use either metal or nylon bolts to mount the landing gear, the nylon bolts, when used exclusively, sheared on landing."

Metal bolts are recommended to fasten the landing gear and for the forward wing hold-down bolt. In the event of an impact, the wing pivots on the forward steel bolt.

Interestingly, it's not only R/Cers who use this ship to sharpen battle skills. The Airplane Factory reports that at the White Sands missile range in Nevada, the Raytheon Company has been using the Kombat 40 to site in the radar on the Patriot missile (used in Desert Storm to defend against Scud missiles). The plane is equipped with a YS .45 and a tuned pipe, and it carries two fuel tanks. It takes off about 3 miles from the missile site and is handed-off

(Continued on page 65)



David Baron uses a Dremel Minimite to a drill hole in the sheared nylon bolts that held the landing gear. The nylon plugs were removed with a screwdriver and replaced with metal bolts.

SPECIFICATIONS

Type: *Bolt-together combat ship*
Wingspan: *48 inches*
Length: *36 inches*
Weight: *4.5 to 5 pounds*
Wing Area: *540 square inches*
Power Req'd: *.40 to .46 2-stroke BB*
No. of Channels Req'd: *4 (rudder, ailerons, elevator and throttle)*
Sug. Price: *$69.95 postpaid*
Features: *The kit comes with semisymmetrical, rubberized, plastic wings, an aluminum tubular frame, landing gear, nylon bolts and all ancillary hardware. The plans are drawn using Autocad.*
Comments: *This rugged, nearly indestructible combat aircraft can be assembled in a single sitting. We proved that it can be repaired in minutes, even after severe crashes.*



We installed the JR Max 4 FM radio—a good, low-end, 4-channel unit—in the Kombat 40.

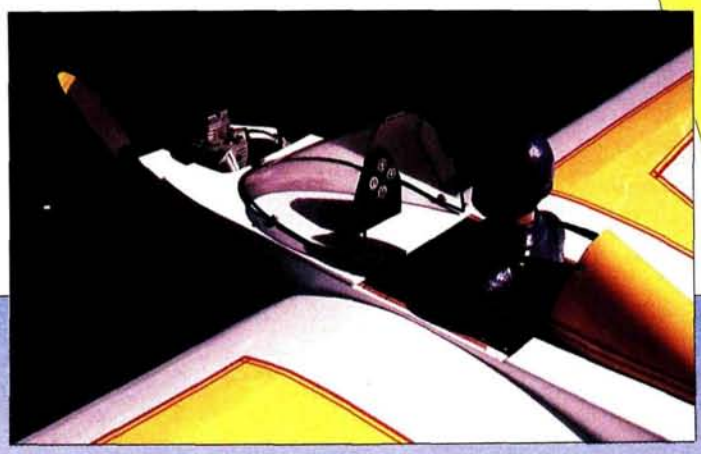
Although nylon hold-down bolts are suggested for use in the wing and the landing gear, we recommend that you use metal bolts for the gear and the forward wing bolt.

THE FIRST TIME I carried the Minimax from my truck and set it up at the field, a group of self-appointed critics gathered like flies over spilt syrup and started making derogatory statements, such as, "Where did you find the Ugly Stik's uglier cousin?" and "You've had some ugly ones, but this one beats them all." They were surprised to see the Minimax as a 1/4-scale model of a home-built ultralight kit. I admit that beauty is in the eyes of the beholder and, even in my eyes, the Minimax is ugly...in a cute sort of way!

1/4-SCALE MINIMAX

by FLOYD MANLY

An unusual ultralight





CONSTRUCTION

We've all seen the ads in R/C magazines for the full-size Minimax that's manufactured by TEAM Inc.* (Tennessee Engineering and Manufacturing). When I stumbled upon a feature article in Volume 1 of Affordable Aircraft (a magazine about ultralights), I fell in love with the ugly little thing. The full-size kit costs $3,300 (including engine). Some R/C aircraft cost more than that, but I decided a long time ago that I'd never live to be an old, bold pilot, so I had better not be a pilot at all, except for R/Cing. (Did I ever tell you about the time I taxied an F-94 in afterburner?) So, I wrote to TEAM and asked for its presentation kit. I received a few photos, spec sheets and a three-view drawing. A light bulb immediately lit up over my head when I saw that the wingspan was 25 feet. Perfect! A 1/4-scale Minimax would be only 75 inches!

If you're a warbird pilot, these figures aren't going to impress you at all, but if you're looking for something unusual that flies like a kite on a string, then you'll love the Minimax. I call mine the "Happy Hopper" because it will hop into the air, and I can lay back with a happy smile on my face.

...if you're looking for something unusual that flies like a kite on a string, then you'll love the Minimax.

WINGS

Cut out all the ribs from the balsa as shown on the plans. Note which ribs require access holes for the servo leads, alignment pin tubes and turnbuckle eyescrews. Do this before you start assembly; it will save a hassle later.

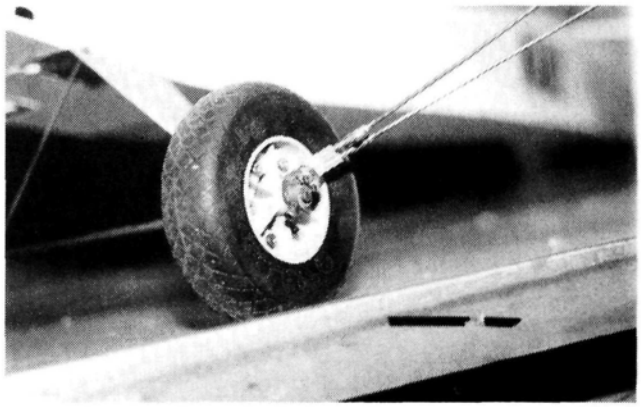
Lay out the bottom spar, glue all the ribs, and add the top spar. Slide the leading-edge and trailing-edge sheets under the ribs, then glue them. Add the sub-leading edge, the top leading-edge sheet, the sub-trailing edge and the top trailing-edge sheet. You can glue on the top and bottom capstrips and the bottom-center bay planking now. Don't add the center bay's top planking until after you've installed the servo lead tube, the wing-attaching eyescrew and the wing-alignment pin tubes. Be sure to allow for the dihedral by propping up the wing tips, and make sure that the mounting tubes are level when you install them. To ensure that the tubes are correctly aligned, use the wing-attaching pins with the wings butted up against each other. (The wing has zero incidence.) These tubes carry the load of the fuselage, so anchor them securely and then epoxy them.

SPECIFICATIONS

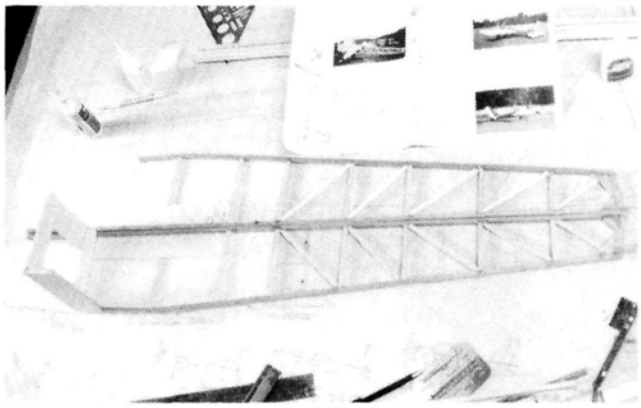
	FULL-SIZE	MODEL
Wingspan	24 feet	75 inches
Wing area	112.5 square feet	940.5 square inches
Length	15 feet, 6 inches	45 inches
Empty weight	237 pounds	7 pounds, 1 ounce
Wing loading	3.82 pounds/square foot	17.3 ounces/square foot
Engine	Rotax 277 (28hp)	O.S. 70-4
Top Speed	60mph	15 mph (approx.)
Cruise	55mph	10mph (approx.)
Stall	26mph	3mph (approx.)
Landing/flaps	22mph	4 to 5mph
Takeoff (grass)	150 feet	4 feet (shortest)
Landing (grass)	180 feet	8 feet (shortest)



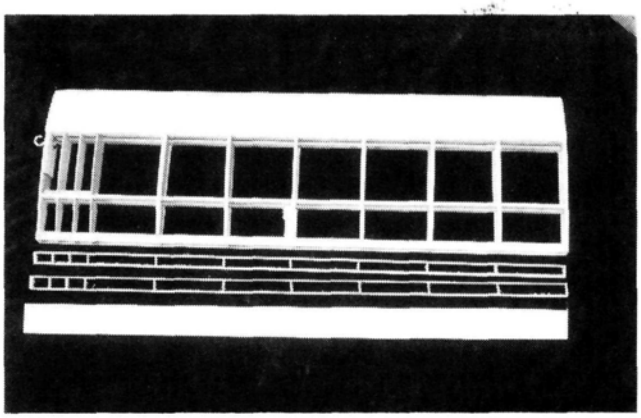
The fuselage is ready for the cowl and the wings.



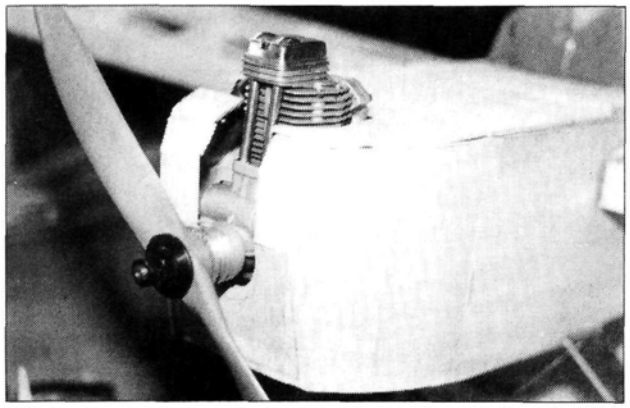
The wing-strut-to-wheel-axle attachment lug.



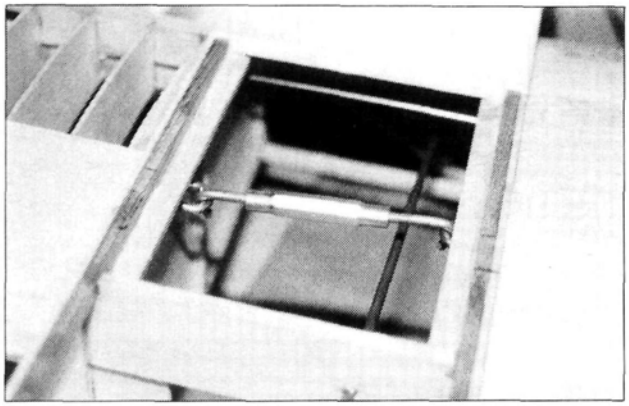
This is the layout of the left and right fuselage sides, which are made of of lite-ply and spruce.



Full-span ailerons are cut away after the wings are built.



"It's functional," is the only nice thing that can be said about the Minimax's nose.



An aluminum turnbuckle holds the wing panels to the fuselage.

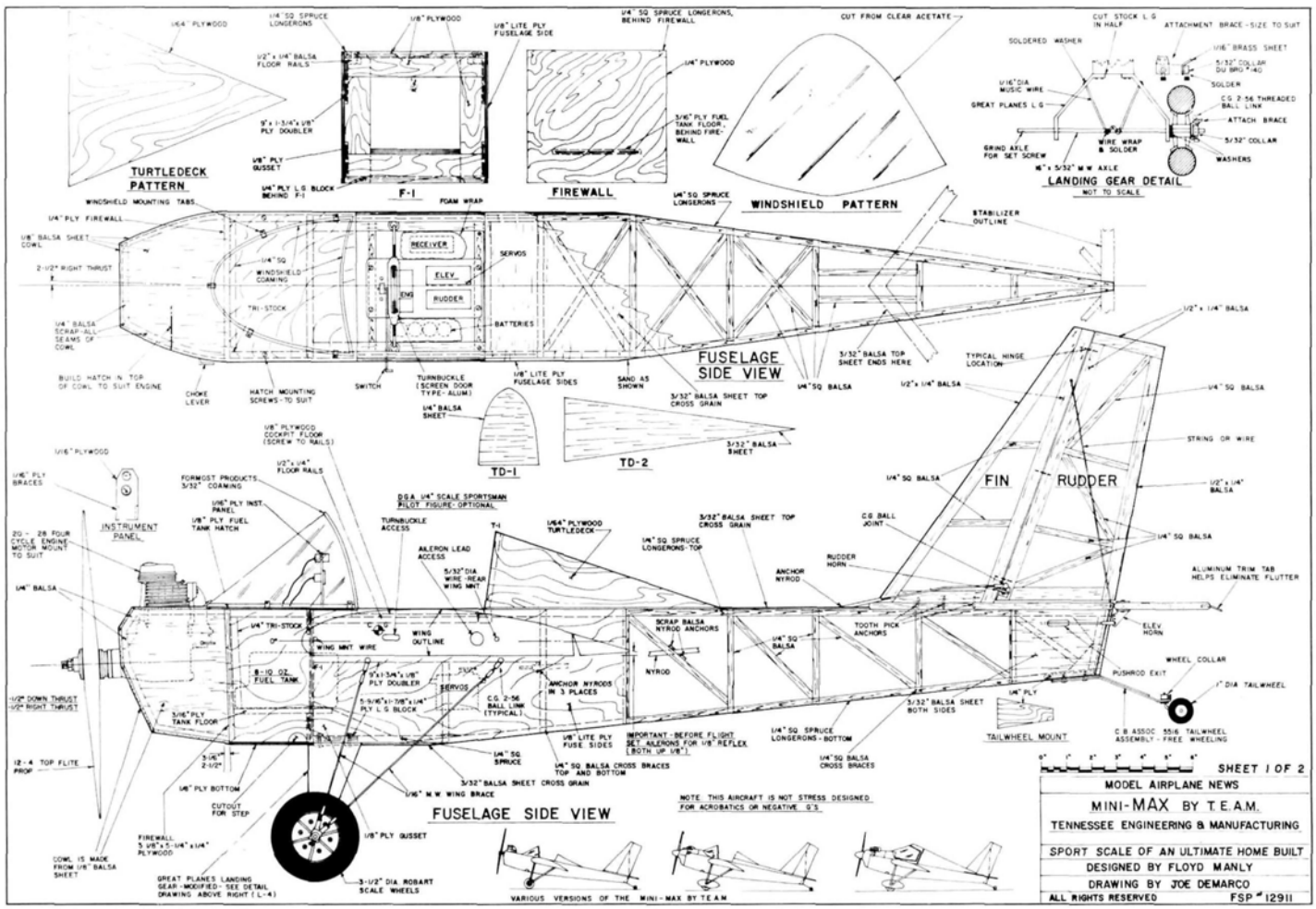
MINIMAX

When the center-bay top sheeting has been completed, cut the ailerons loose. Measure and mark the top and bottom lines, then use an X-Acto saw blade (with its back removed) to cut through both sheets and the ribs. Now, make a second cut on the aileron to remove enough sheeting and rib material so that the aileron sub spars can be added. To finish the wing, add the aileron-horn pad, the strut-attaching points and the servo mounts. Now, make the other wing. (The tail planes are of simple stick construction, so there's not much to say about them.)

Ever since I built two right-handed fuselage sides and two left-wing panels, I feel I must remind others not to do the same.

The fuselage is made with lite-ply sheets, spruce sticks and balsa sticks. Cut out the plywood sides, then add the doubler. Drill, cut and shape all the holes for the wing tubes, servo leads and eyebolts. Check that they match the parts in the wing. To make this job easier, use the center wing ribs to mark the fuselage before the wing is built. (Ever since I built two right-handed fuselage sides and two left-wing panels, I feel I must remind others not to do the same.)

Glue the spruce longerons onto the fuselage sides, and add the balsa verticals and diagonal braces. Make up the ply firewall and the one former. Epoxy the firewall, but glue the former and



spruce with medium CA.

The landing gear is a Great Planes* L-4 that was cut in half. The axle is 5/32-inch music wire, and the strut attachments are made out of wheel collars and brass sheet. Add and solder the V-brace wire after the landing gear has been installed.

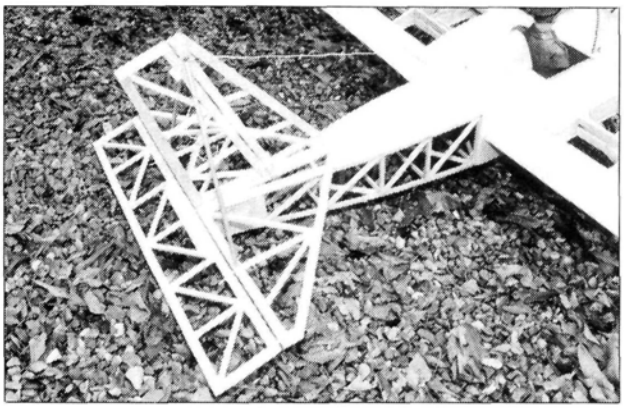
After you add the chin ply plate and the landing-gear plate, you'll have enough completed parts to start fitting the pieces together. Now you can see what your Minimax is going to look like. Uglee…ain't it?

The balsa motor cowl is built with the motor in place, and the tank hatch and the cockpit are a piece of cake. The Minimax must have a pilot, or it will look very weird; any 1/4-scale sport pilot will do. I used a DGA* pilot, but he looks bored stiff with no smile on his face.

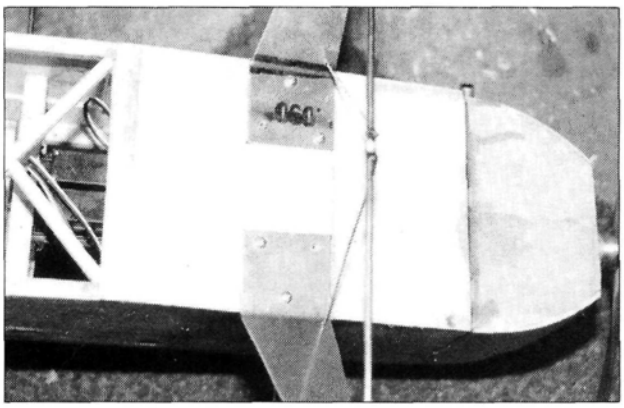
To check the incidence and the dihedral, temporarily install the wings. The only way to adjust the incidence is to plug the rear holes in the fuselage, and then re-drill them. You might be able to adjust dihedral by bending the music-wire attachment, but *I* wouldn't try it. Dihedral should have been adjusted while you were epoxying the mounting tubes.

With the fuselage set up on its wheels, the wings can be propped up with blocks or boxes to ensure that the dihedral is the same on each wing. Then the wing struts can be measured, made up and installed. The full-size Minimax isn't stressed for acrobatics, and I don't believe the 1/4-scale one should be either. It's just for cruising and maybe shooting landings. The controls can be connected with hard balsa pushrods or Nyrods. I used the latter and anchored them in three places inside the fuselage.

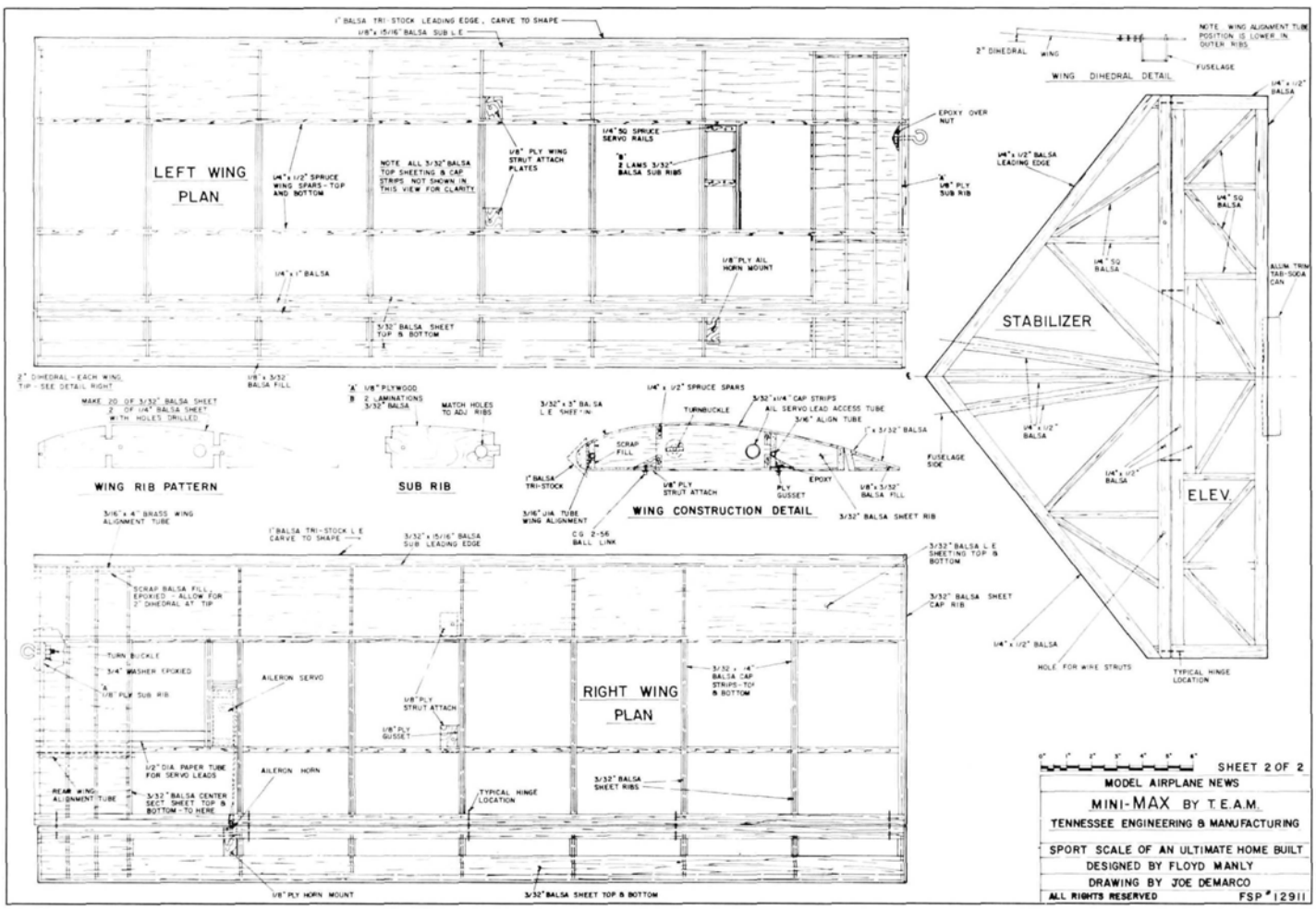
Now that everything has been measured, cut, built and installed, you can take the plane apart so that you can cover it. Because this is a home-built, you can be as creative as you like. I used white MonoKote* as the base color because it's easy to see; then a little yellow



The tail feathers are light and strong; cover them before you glue them to the fuselage.



Great Planes' L-3 gear is cut to increase the landing-gear width.



ORDER THE FULL-SIZE PLAN FROM THE BOUND-IN PLANS DIRECTORY ON PAGE 4.

MAN-CARRYING MODEL?

by GERRY YARRISH

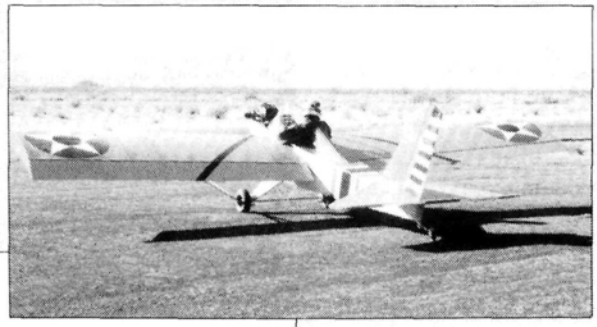
Aviation has been in a constant state of change ever since the Wright brothers started their airborne adventures. Since the beginning, models have been used in conjunction with full-size designs to test new ideas and configurations. Today, the differences in size between some full-size aircraft and the model versions aren't that great. R/C models with wingspans approaching 29 feet, i.e., Byron's B-29, have been flown successfully, and their fidelity to scale has thrilled onlookers.

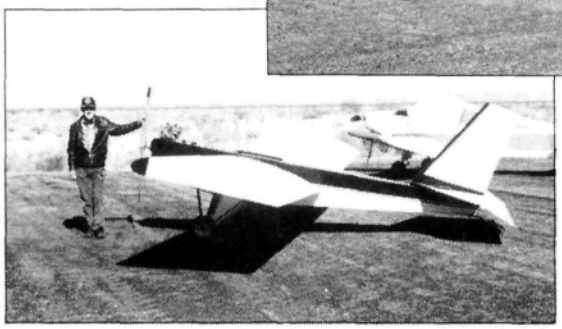
Full-size aircraft that have become smaller have given birth to the ultralight and microlight classes of man-carrying aircraft. It's little wonder that the differences between giant-scale models and home-built ultralights are becoming harder to define.

An example of this phenomenon is Tennessee Engineering and Manufacturing's Minimax—a full-size, all-wood, ultralight aircraft with a 2-stroke engine. It includes traditional materials (spruce and plywood), and it's built using the wood-truss and gusset method. The tail surfaces are of stick construction, and they're built flat on a workbench.

The Minimax is covered with heat-shrink Dacron, and it comes with a hardware package that includes all the metal parts and fittings. Step-by-step instructions and well-thought-out blueprints guide you through the construction, and the whole project will take average builders approximately 300 hours. It sounds more like model construction than full-size aircraft fabrication.

You can build this plane in your basement; then you can take it to the flying field, climb aboard and actually fly away in it. Of course, serious flight training and education are a must. If you're ready to fly high in your own creation and relive the thrill and excitement experienced by Orville and Wilbur, the Minimax could be the model...erhhh!... aircraft for you.







These three full-sized Minimaxes look just like oversized R/C models. They share all the building techniques and materials of giant-scale models!

EconoKote for accent because it goes on at a lower temperature. Finally, I made inexpensive stripes with tape from an auto-supply store.

Install the radio after you've checked the CG location. I used a Futaba* 7UAF, but that's like putting a computer in a kiddie car. The servos can be moved approximately 3 inches fore and aft and, depending on the motor you select, the battery pack can be located in front of, along side of, or under the servos in order to balance your aircraft. I used an O.S.* .70-4S, but this is a heavy engine for this aircraft, and initial flights indicated that it was much too powerful. A .40-4S or a .46-4S should be more than adequate. Just promise me that you won't put a screaming 2-stroke in it; maybe an electric, but no 2-strokes, please!

PERFORMANCE

Remember, the Minimax is a 1/4-scale version of an ultralight aircraft that flies at 55mph. Attempt to recreate this picture with slow, easy flying that's relaxing and pleasurable.

It took a couple of flights to get the trims dialed-in. A photo of a full-sized Minimax showed it cruising with both ailerons drooping, and it had lots of up-elevator. The full-size aircraft has flaperon function, which I chose not to use for simplicity's sake. I set up the ailerons in this configuration because the picture showed it, but the model would wallow and hunt...generally, it wasn't much fun to fly. When I took out the flaps, things improved. Then I added a couple degrees of reflex, and the Minimax turned into a friendly aircraft that's a joy to fly.

To date, I haven't tried a loop, or a spin, or any other stressful maneuver. If I want to fly acrobatic sequences, I'll use my Ultimate Bipe.

As I mentioned earlier, that .70 4-stroke and 12x6 APC glass prop were much too powerful, and the first flights were flown at less than 1/4 throttle. Further hops were made with a Top Flite* wooden 12x4, and the speed variations were controlled more easily. The Minimax does have a tendency to swoop when the speed builds up.

Takeoff rolls can be less than 6 feet, but it's more realistic to bring the throttle up slowly and stretch them to 40 to 50 feet. I quickly found that rudder is a big help in making smooth turns. Once the Minimax is airborne, sit back and enjoy some lazy cruising just under the clouds.

**Here are the addresses of the companies mentioned in this article:*
TEAM Inc., *Rte. 1, Box 338C, Bradyville, TN (tel: 615 765-5397).*
Great Planes Model Manufacturing, *P.O. Box 788, Urbana, IL 61801.*
DGA Designs, *135 E. Main St., Phelps, NY 14532.*
MonoKote; *distributed by Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*
O.S.; *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61824.*
Top Flite Models, *see above.* ■

SMALL STEPS

AMAZING MINIATURES

by JOE WAGNER

THE INGENUITY and adventurousness of SMALL (Small Model Airplane Lovers League) members continues to amaze me. There seems to be no limit to their offbeat, challenging projects! True, at flying fields, the "big" R/C airplanes usually outnumber the miniatures, but most of the larger models are stock kits or ARFs—not so the little ones!

MODIFIED MINIATURES

This summer, I saw many extraordinary, mini, R/C airplanes in flight, including Jesse Shepherd's* tiny "Skoots." It's an R/C version of a slightly smaller, all-sheet-balsa, rubber-powered model, and he sells it in kit form. Though Jesse has been active in free-flight since Lindbergh crossed the Atlantic, the Skoots is his very first R/C model. It flies extremely well!

Guillow's built-up scale models, e.g., Hellcats, Focke-Wulfs, P-40s, etc., have been adapted to R/C by several intrepid modelers who have sent me photos of their projects. Unfortunatey, few of the pictures have been good enough to use in this column. Bob Kress of Kress Jets* (the famous ducted-fan company), however, sent me some fine pictures of a truly mind-boggling model—his Sterling Flying Fortress R/C conversion. It's powered by a single Tee Dee .049 (mounted in the bomb bay) that drives four scale-size props in the nacelles by means of a cleverly engineered belt-and-pulley system that Bob in-

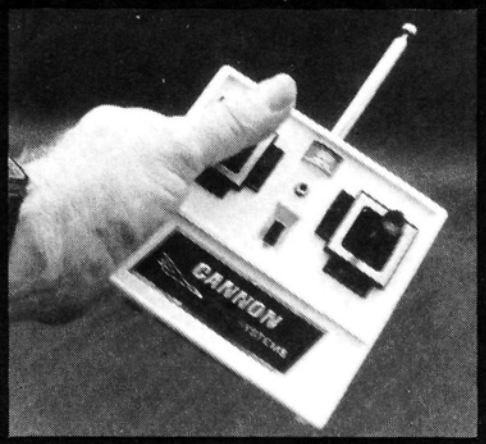


Although the King Condor has a mighty big airframe for the little Cox QRC that's up front, it climbs well, and its glides are extremely flat.

MINI MODEL EQUIPMENT

R/C models that are the size of Jesse Shepherd's Skoots and Bob Kress's B-17 are only possible with the use of micro-size R/C gear. There are several companies that offer such equipment, but I've just heard word from Bill Cannon that Cannon R/C Systems* now offers 1991-legal, narrow-band versions of its world-famous sub-miniature R/C systems—the smallest, lightest available anywhere. This is welcome news!

Cannon has made narrow-band transmitters for years, but this is the first time they've made narrow-band receivers. There are two: the 1/2-ounce Super-Micro and the 1-ounce Super-Nova. Both are available in systems with from two to six channels and with a variety of transmitter options, i.e., single-stick, servo-reversing, dual rates and mixing.



Cannon R/C transmitters are "mini-sized," but they have all the power and optional features of "standard" transmitters.

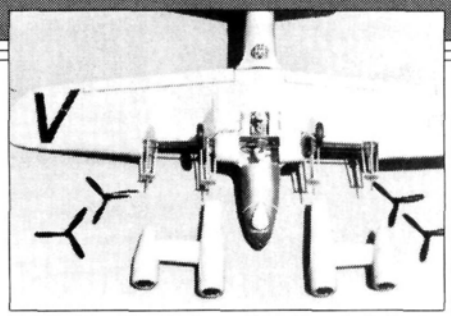
Cannon's equipment isn't cheap because, in effect, it's custom-built. With other manufacturers, you have to take what they make, but Bill Cannon can provide you with what you *want*, and everything is made in the U.S. His new catalogue is now available and, when you send for it, ask for a copy of the latest *Charlie's R/C Goodies* catalogue, too; it's loaded with new electric-powered items!

vented and patented.

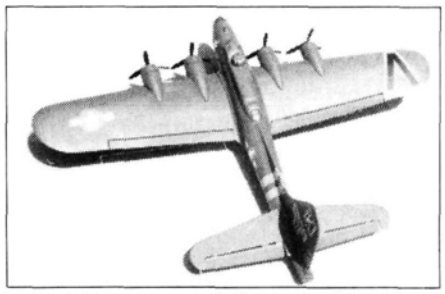
Another out-of-the-ordinary rubber-powered conversion is my Goliath* King Condor. (It's a mighty impressive name, but so is the airplane!) It's a 74-inch-span, 54-inch-long, all-foam model that's advertised as the "world's largest" rubber-powered aircraft. Mine was made from Goliath's R/C version kit ($15). This *isn't* an ARF kit! All of the foam parts are supplied, and they're the best expanded-polystyrene components that I've ever seen. Installing the engine and the R/C system is strictly a do-it-yourself proposition, though. The instructions suggest a couple of R/C and engine installations, but I worked out my own setup.



Here's Jesse Shepherd with his prototype, 25-inch-span Skoots. (The flight testing preceded decoration!) It requires two channels and uses a Cox .010 for power.



In this view of the bottom of Bob Kress's B-17, the nacelles have been removed, and you can see how the Cox Tee Dee .049 in the bomb bay drives the four props. (A small prop on the engine keeps it cool.)



The B-17 looks very realistic, and from this angle, there's no way to tell that it's a single-engine R/C model! It weighs 42 ounces and requires two channels (ailerons and elevator).

My King Condor flies exceptionally well. Its 630-square-inch wing area seems like a lot for a Cox reed-valve .049 to drag upstairs, but the model's design is clean and, ready to fly, it weighs just 28 ounces. In the air, it looks much like a Lockheed U-2 reconnaissance jet. In fact, now that I know how well the King Condor performs, I might assemble another—modifying and painting it to produce a low-cost, yet impressive, stand-off-scale U-2.

**Here are the addresses of the companies mentioned in this article:*

Jesse Shepherd, *Aero-Crafted Models, 2713 Summit View, Bedford, TX 76021.*

Kress Jets Inc., *4308 Ulster Landing Rd., Saugerties, NY 12477.*

Goliath Whirlwind Aircraft Inc., *2501 Williams Dr., Waterford, MI 48328.*

Cannon R/C Systems, *2828 Cochran St., Ste. 281, Simi Valley, CA 93065.*

Kustom Kraftsmanship, *P.O. Box 3010, Fallbrook, CA 92028.* ■

COX ENGINE LOVERS UNITE!

Here's good news for Cox engine lovers! Joe Klause of Kustom Kraftsmanship* sells an astounding array of custom Cox components through the mail.

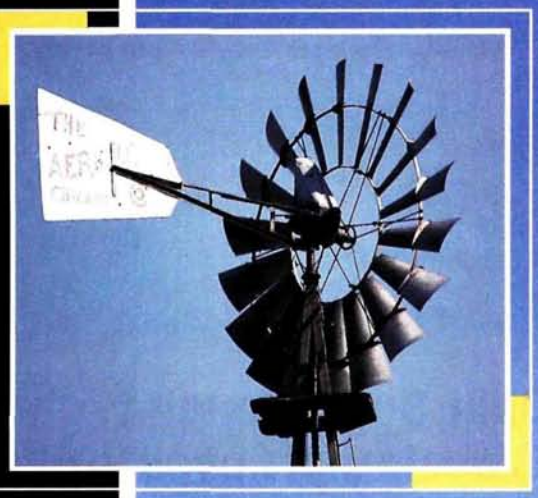
Most 1/2A fliers are already aware of Joe's special needle-valve assemblies for Tee Dee .049 to .09 engines, but few know that, for Cox reed-valve engines, he makes backplate assemblies that incorporate his finely threaded, airtight needles. And that's not all! The Kustom Kraftsmanship catalogue is full of upgraded Cox 1/2A items: stress-relieved crankshafts; crankcases with bronze main bearings; pressure-type Tee Dee backplates; cylinder shims; hard-chrome-plated crankshafts, etc. Joe also sells customized versions of all Cox engines, except for the Dragonfly and the Queen Bee. (He's thinking of offering those, too, if there's sufficient demand for them. Let him know if you're interested!)



Here's a sample of Kustom Kraftsmanship's custom Cox components: reed-valve .020 and .049 tank-end assemblies; a bronze-bushed case for the Black Widow, etc.; radial mount and "pressure" backplates for Tee Dee .049 and .051 engines; and finely threaded, airtight needle-valve assemblies for the Tee Dee .05 and .09.

Joe recently sent me a sample of something that promises to be truly revolutionary in the 1/2A engine line. I haven't had a chance to test it much yet, but with Joe's reputation to back it, I'm sure it will be a winner. I'll tell you all about it in my next column!

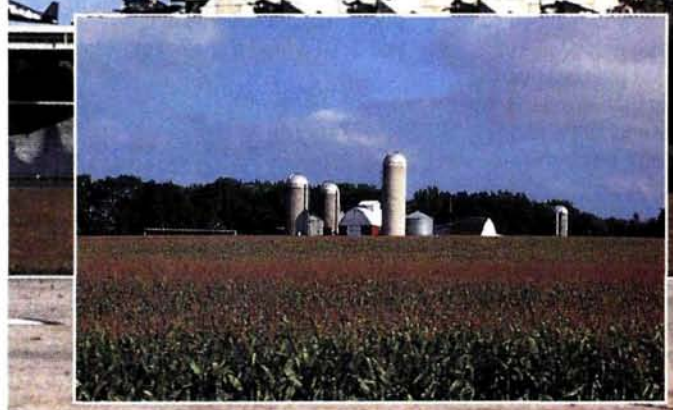
TORA! TORA



BYRON ORIGINALS' 1991 Aviation Expo—*the first I've attended—was a colorful, kaleidoscopic R/C festival; a dazzling full-scale aviation spectacle; and a rousing reenactment of the bombing of Pearl Harbor, the Battle of Midway and the conclusion of WW II. Played out each day for five days, running from August 7 through August 11, the Aviation Expo ranged from the moving to the comedic and was guaranteed to bring out feelings of patriotism and pride in our country's aviation technology.*

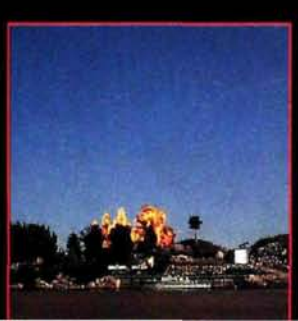
Byron Aviation EXPO '91

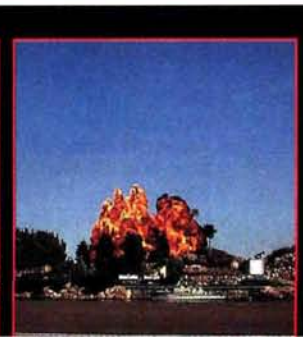
by TOM ATWOOD

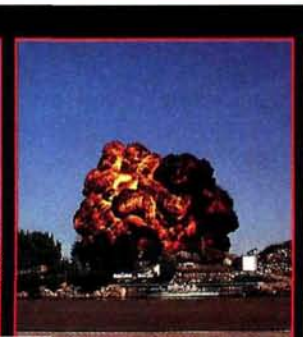


PHOTOS BY YAMIL SUED & TOM ATWOOD



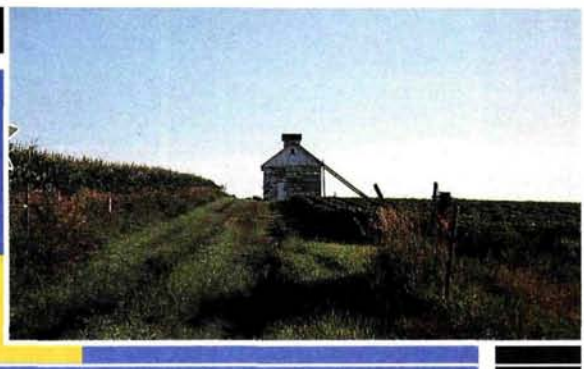








TORA!





A small section of the viewing area on the right half of the expansive flight line shows a spellbound crowd during Striking Back.

A giant fireball lights up the Byron 1/5-scale set. Below, stop action captures the simulated atomic blast at the end of Striking Back. A telltale heat flash could be felt from the flight line. The other insets were taken in the rich Iowa countryside while driving to Ida Grove.





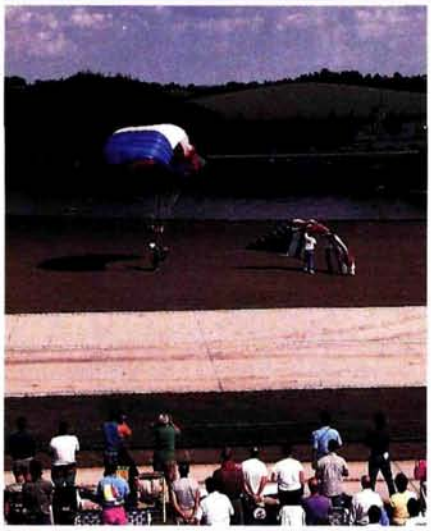
BYRON EXPO

Imagine a 40x600-foot, concrete R/C runway (complete with taxi ways and flight-line traffic assistants) and hundreds of gorgeous giant-scale and ducted-fan aircraft parked on the flight line. Think of being one of eight pilots flying while thousands of people crowd the grandstands and grassy areas behind the flight lines. When you're tired of flying and talking with other pilots, you can take a break, visit the concession stands for food and refreshment, and then tour the approximately 70 manufacturers' exhibits to see the latest R/C product. Sound too good to be true? This is only the beginning of the fun at the Aviation Expo.

At 4:00 in the afternoon, R/C flying turns the stage over to a combination of events that include (but aren't limited to):

- a dazzling, full-scale air show that includes parachutists, low-altitude, precision aerobatics and exhibition flying by world-class pilots;





▲ *The show starts: the Holiday Inn Aerobatic Team, flying four Pitts Special Biplanes, circle a parachutist carrying a giant U.S. flag. Aaron Copeland's "Fanfare for the Common Man" was played over the loudspeakers as the planes roared above—quite moving.*

◀ *The parachutist lands as the Holiday Inn Aerobatic Team begins its performance.*

The Holiday Inn Aerobatic Team in a formation flyby. ▶





▲ *Capt. Jim Mynning astonishes the crowd with his high-flying comedy act. He's the sole pilot in his modified Piper Super Cub.*



◀ *The Holiday Inn Aerobatic Team in a vertical starburst.*

Morning aerial view, taken before the crowd grew thick, shows the large Aviation Expo site. Large tents toward the rear housed concession stands, a ton of manufacturers' booths and more. ▼

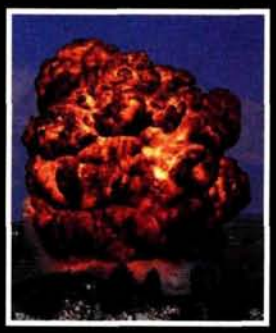


▲ *Confederate Air Force warbirds were readily accessible at the nearby municipal airport.*





◀ *Holiday Inn Aerobatic Team at the bottom of a bomb-burst maneuver.*



Ground zero: primer cord detonates 140 gallons of gasoline to simulate an atomic blast. ▼



▲ *Two full-scale Japanese warbird replicas fly over the Byron grounds during the Tora! Tora! Tora! phase of Striking Back.*





The raising of the flag at Iwo Jima is re-enacted by former soldiers who fought on that island.

▼ *A full-scale replica of a Zero makes a low-altitude strafing run.*





A mortally wounded Zero spews smoke before a fiery crash.



Scratch-built, scale Sherman tanks used in battle weigh 2,200 pounds The driver shoots 12-gauge black powder charges to fire the main gun.



▲ *The myriad explosions and pyrotechnics were carefully orchestrated from the control panel in the Byron control tower.*

As the full-scale planes attacked, the voices of Japanese pilots could be heard over the loudspeakers. ▶



Far right: Part of the crowd is briefly shrouded in smoke. Here's realism you won't find in a movie theater!

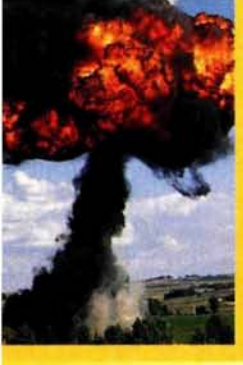


• extraordinary R/C team and solo exhibition flying;
• a dramatic re-creation of major WW II air battles that's so realistic that you can easily place yourself on the scene in a way that's hardly possible at the big cinema (e.g., army issue, propane 30- and 50-caliber machine-gun simulators are used; the smoke from the battle sometimes drifts over the crowd);
• authentic, low-altitude WW II warbird flybys that let you see and hear what these aircraft really were like.

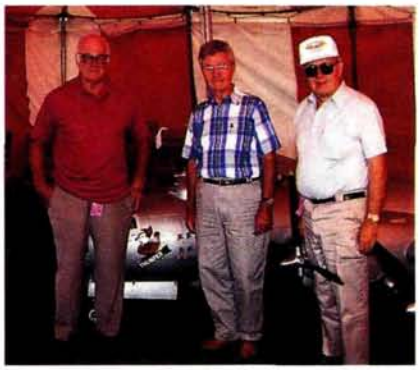
THE EXCITEMENT BEGINS

That you're in the American heartland first hits you while traveling in Iowa to Ida Grove, home of Byron Originals. Yamil Sued, our staff photographer, and I flew into Omaha and drove for 90 minutes through rich farm country on our way to the massive Byron Expo grounds. We saw corn fields extending as far as the eye could see, pig farms, huge expanses of farmland dotted with grain silos and farms—there was no mistaking we were in part of the breadbasket of America.

In Ida Grove, I was struck by the almost Disney-land-like touch to



BYRON EXPO '91



Thomas Ferebee (bombardier), Paul W. Tibbets (pilot) and Theadore Van Kirk (navigator)—the original Enola Gay crew—stand next to a static 1/5-scale model of the famous B29.

Mort Huber's B-36 is escorted from the flight line. Pilot Scott Russell described the airplane as "...very docile in flight, and stable, although it can be nerve-wracking" if you lose an outboard engine!



some of the Byron buildings. Parapets and crenelated walls as in the castles of old could be seen here and there. As we took this in, a full-scale P-51D Mustang flew by in a low pass, and then we spotted several R/C models flying just above the horizon.

We pulled into the Expo grounds, right across the street from a municipal airport crowded with Confederate Air Force warbirds. As we walked to the immense R/C flight line, about a dozen parachutists could be seen floating down to the sky-diver drop zone. We passed by large tents holding vendor exhibits, a general store, concession stands, the main Byron tent, and finally a miniature control tower overlooking the runway. In front of the spectator area and the tower was a feast for the eyes—beautiful giant-scale models and their proud owners were spread for hundreds of feet. Thousands of spectators crowded to see the action (the estimated attendance over five days was 45,000).



◀ Two Byron F-15s proceed down the runway in a tight formation in one of the riveting performances by the Cloud Dancers International Show Team.

During the frenetic carnage of Striking Back, two models collide on the runway.



MODELS, MODELS, EVERYWHERE

The number and diversity of sophisticated models was astounding. To fly at this year's Expo, your propped plane had to comply with IMAA rules for giant scale (e.g., at least 1/4 scale, or wingspan of at least 80 inches). Ducted fans weren't subject to this size restriction.

If you're going to fly at the Expo, you might as well take something really worth showing off, right? Hundreds did—563 aircraft were brought by approximately 290 pilots who flew a total of 1,125 flights, and these were just the participants, not exhibition fliers! According to Byron's computerized frequency-control system, participants logged a total of 20,550 minutes in the air (342.5 hours).



Al Ward's eye-opening Byron Corsair is powered by a G 62 spinning a three-blade, 20x12"TOC" prop available from Precision Products. The plane flew so well that it drew much attention on the flight line.



▲ Will Bonefas, pilot, aircraft mechanic and Confederate Air Force Pilot, stands in front of his replica Kate—a Nakajima BN5. Will is one of the Tora Tora Tora pilots.



◀ Mark Enderby's Balsa USA Stearman—the prototype kit—was a real gem on the flight line and in the air. The 45-pound plane was powered by a Sachs-Dolmar 4.2 spinning a 24x10 prop.



Ron Goodrich and his 1/4-scale Cessna Caravan. Designed for a cross-country endurance record, the model has a 14-foot wingspan and is powered by an A&M Sachs 5.8.

Amazing models ranged from Chuck Bowman's (Lenox, IA) amazing 1/2-scale, 98-pound Piper Cub (quite hard to distinguish from the real McCoy in the air) to Harry Wood's (Long Beach, CA) tiny MiG-15—a near duplicate of Robert Hahn's famed miniature of last year, now using an .09 Kress Jets fan. Bernie DeBore, of Lemar, IA, flew a scale space shuttle that, when launched off the back of another plane at an altitude of several hundred feet, barely made one full circle over the field as it came down for a high-speed, very scale-like landing.



eorge Hartshorn, from ake of the Ozarks, MO, as unmistakable on the ight line; he flew a 1/4-cale, blue-and-white J-3 ub.

Al Ward, of Akron, CO, flew a high-powered Byron Corsair so authoritatively that a group of pilots quickly approached him after one of his flights. Al lives "a mile high" and first flew his Corsair with a G 62 spinning a two-blade, 24x10 prop. In the meantime, he was experimenting with his P-38, built from a CBA kit, which also uses Zenoah 62s. In his search for the greatest performance for the P-38, he tried the so-called "TOC prop"—a three-blade,



Ken Bryan lands the Byron B-17 during the Striking Back performance.



THE BIGGEST B-29

Many may recall the mighty Byron 1/5-scale B-29 that was lost two years ago at the Expo. Modeled after the Enola Gay, the giant returned this year in magnificent form. Project engineer and chief pilot Ken Bryan noted that the model has a fiberglass fuse and nacelles, much like any Byron kit. The wings, which span 29 feet, are wire-cut foam-cores that are covered with fiberglass cloth and epoxy resin. A 1/2-inch-thick plywood spar tapers to a 1/4 inch at the tip.



PHOTO, ROD JOBMAN

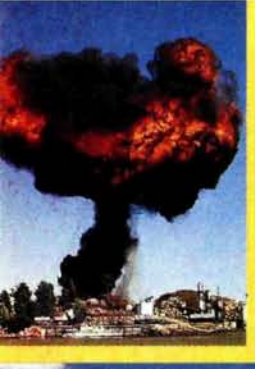
The B-29's engines are Quadra 100s, and they spin the Zinger 26x8-14 propellers at approximately 5,800rpm. The plane uses a redundant Custom Electronics radio system. "If we get a frequency clash of some type, we switch automatically to another frequency. I never know when that happens," Ken said. The plane operates on six channels—the standard set plus flaps and retracts. To control brakes on the ground, team partner Ken Bundt operates a separate radio system (a seventh channel).

As for the plane's handling, Ken Bryan notes, "Any time you get four large engines out there with gyroscopic precession in a plane this size, you have more of a mass to overcome all the time...It feels heavy in that you don't have quick roll rates." He adds, "You can tell a big difference when you input your rudder correctly. It's not a difficult aircraft to fly."

The plane amazed a crowd of thousands but, unfortunately, two of its engines lost power during one of the Striking Back shows. As the crowd gasped, the plane slowly sank behind the trees hundreds of feet from the flight line. It didn't suffer major damage, and it's expected back next year.



Pilots Ken Bundt (left) and Ken Bryan stand next to the 1/5-scale Byron B-25 and B-29 models in the Byron hangar.



BYRON EXPO '91

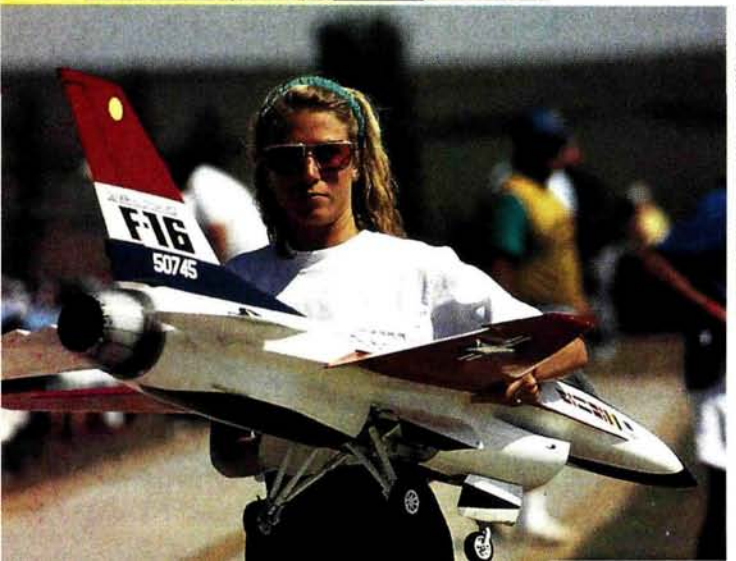


A close-up of the SU-26 cockpit; the pilot sits in a reclined position. The Sukhoi is an unlimited competition machine made of composites, stainless steel and titanium.



▲ A Russian SU-26 and its Byron Originals counterpart stand proudly on the tarmac.

◀ Clint McHenry, internationally acclaimed, master aerobatic pilot (left), Byron Godbersen, Byron Originals founder and the driving force behind the Aviation Expos (middle), and Ken Bryan, project engineer and pilot of many of the largest Byron exhibition models (right), stand in front of the full-scale Russian SU-26.





▲ Pilot Debbie Gruvich and her highly modified Travelaire Mystery Ship. A prototype kit by Larry Scott, the model is powered by an OPS Maxi turning a 24x8 prop.

◀ Jet pilot Patty Violett carries the Bob Violett Models F-16 on the flight line.

20x12, composite prop sold by Precision Built, Inc., of Spring Branch, TX. Using a telemetering device from Condor R/C (air-speed indicator with downlink), he found the P-38 was flying 97mph, straight and level, with gear down and flaps extended. The props pulled so well that he decided to try them on the Corsair. Combined with the G 62, the result was eye opening.

Ron Goodrich of Winnemac, IN, brought a 50-pound Cessna Caravan powered by an A&M Sachs 5.8. Equipped with an Airtronics Vision radio, this impressive plane is designed to make a major cross-country endurance flight. The plane's fuel tank holds 4.5 gallons. Pulled by a three-blade 24-x10, the Caravan is made primarily of balsa with foam wings and stab.

On the unconventional side, Tom Blakeney, of Fort Worth, TX, flew an 11-foot, scaled-up Kling-berg Wing (two small vertical fins were added) that was powered by a Super Tigre .61 pusher. Despite having 5 pounds of ballast in the nose, its wing loading was only 19 ounces per square foot.

Jim Greenly, of Albuquerque, NM, flew a majestic 1/4-scale Bearcat that had been scratch-built from blown-up Nick Ziroli plans. Everything was handmade—from gear to cowl. The plane is equipped with a smoke system and redundant batteries and is motivated by a Sachs 5.8 that turns a 22x14 prop at about 7200rpm. He has been flying this showstopper for about two years. His next project?—a 1/4-scale Sea Fury that will spin a 3-foot-diameter, five-blade prop.

Scott Russell flew a B-36 that was impressive not only because of its size (wingspan:16 feet, 4 inches), but also because of the beautiful resonance of its six ASP .61







GROWN-UP CUB

Whenever hundreds of R/C aircraft are gathered for some serious flying, there are always one or two unforgettable models. This year, Chuck Bowman's amazing 1/2-scale, 98-pound Cub was a unique crowd pleaser. The model's frame was made of aluminum 6061 T-6 tube, heli-arc welded, just as in the full-scale plane. Chrome/moly landing gear carry lawn-mower tires ground down to remove the treads. The wing utilizes Styrofoam ribs, some of which are sheeted with 1/8-inch light ply.

The plane is powered by an OMC twin-cylinder, opposed, 215cc, 16hp snowmobile engine that spins a 48-inch ultralight prop cut down to 36x28 size. The plane has 6,760 square inches of wing area, a wingspan of 216 inches, a fuse length of 11 feet, 1 inch, and it carries CH electronic ignition. It was covered in 75 feet of Sig Coverall that was finished with 9.5 gallons of reduced Sig dope. Chuck put two JR PCM receivers in the giant Cub; one to control the right side and one the left side. "If something happens to the radio on the right side, I still have enough control on the left side to get the airplane down."

Nine Futaba S134 servos are used: one for each aileron, two for rudder, four for elevator (two each side) and one for the throttle. Forty feet of servo extensions are used, and two 1200mAh battery packs support the separate radios. Question is, will Chuck build a real one next?

engines. Owned by Mort Huber, of St. Paul, MN, the plane carries nine servos in the wing and two in the fuselage, and it's controlled by pull-pull cable linkages. The plane flew very smoothly, and Scott confirmed that it's docile, like a trainer. "The only thing that can make it nerve-wracking is if you lose an engine, particularly an outboard one." Don Neill brought his well-known Hall Bulldog Racer and also the first glass-fuselage version of his Gee Bee.

Bob Violett and daughter Patty flew the BVM F-16 impressively and also treated the crowd to a first look at the company's new T-33 fan jet in flight. Colonel Bob Thatcher flew a stand-off F-20 that had been clocked "at about 120 flat out—and that's plenty." Don Bell, of Arlington, TX, brought two versions of an interesting, 20-percent scaled-up F-15 built from Nick Ziroli plans. The smaller version was powered by a .46 Turbax fan and seemed to fly competitively with some of the larger ducted fans. Don's "hot-rod" version used a Dynamax fan and an O.S. .77 engine.



Colonel Bob Thacker (right) and Steve Korny prepare a standoff F-20 for flight.

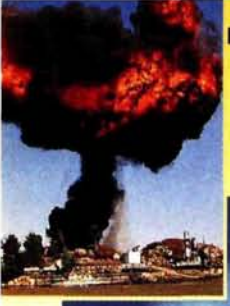
How did the Byron staff handle the hundreds of planes? Tom Pease, in charge of radio frequency management,



Jim Greenly's scratch-built, 1/4-scale, 48-pound Bearcat in a low, slow pass. A modified 5.8 Sachs turns a 22x14 Zinger prop, which provides plenty of power. The plane was built from blown-up Nick Ziroli plans.



Don Neill's Gee Bee carries a Sachs 4.2 engine and C&H onboard ignition. The 32-pound, 4-channel plane, pulled by a Zinger 22x6-10 prop, was built from Don's plans and is the first with a glass fuselage.



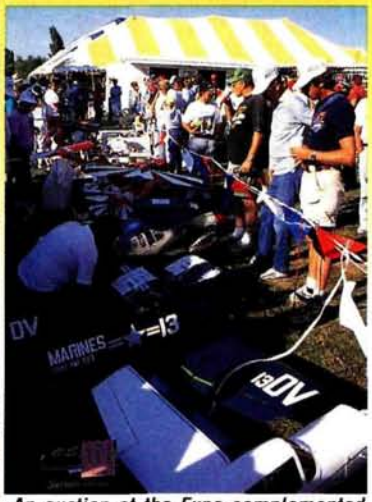
BYRON EXPO



Clint McHenry, winner of four world medals in aerobatic competition, wows the crowds in his Sukhoi SU-26.



Don Bell shows off his F-15, which he 20-percent scaled up from Nick Ziroli plans. The plane carries a Dynamax fan and an O.S. .77 engine, and it weighs 8.25 pounds. ▶



An auction at the Expo complemented the many vendor booths, if you were looking to add to your collection of models!

showed me Byron's system whereby all pilot numbers and channels are recorded on a large chart as well as in a computer system. If a pilot asks to use a given channel, his or her name is placed on the chart in a first-come, first-serve system. The computer determines whether it's a valid frequency. Tom noted that two frequency scanners were running. In turn, Bob Hess was in charge of flight-line management. His people used hand signals on the 1/5-scale set to coordinate incoming and outgoing aircraft, much as would be done at any full-scale fly-in.

ALMOST LIKE BEING THERE

The air show and Striking Back, which this year commemorated the 50th anniversary of Pearl Harbor, were dramatic. The air show commenced with the four Pitts Specials of the Holiday Inn Aerobatic Team tightly circling a parachutist equipped with a large flag. As the formation descended, the roar of each

Catching a Ride

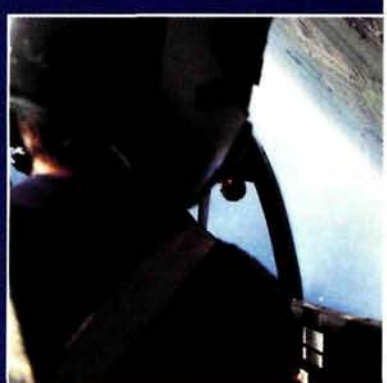
by TOM ATWOOD

At this year's Expo, you only needed to stand in line, sign a waiver and pay a $300 tax-deductible fee (dedicated to the plane's maintenance) to catch a ride with retired Brigadier General Reg Urschler in the Confederate Air Force P-51D Gunfighter Mustang. The CAF, a nonprofit organization, is supported by private donations only and is dedicated to the restoration and maintenance in flying condition of WW II aircraft. Gen. Urschler notes its planes are a reminder of the need to maintain a "credible deterrent posture to protect what we consider our most precious possession—our freedom."

Built in March of '45, this stock, North American-built fighter is one of only 80 to 100 D models still flying. Likely purchase price today? Around $500,000. I asked Gen. Urschler what maneuvers he could do with me on board. "It is not an airplane which is very forgiving when it comes to doing stalls and spins and [we will do] absolutely no hammerheads at all."

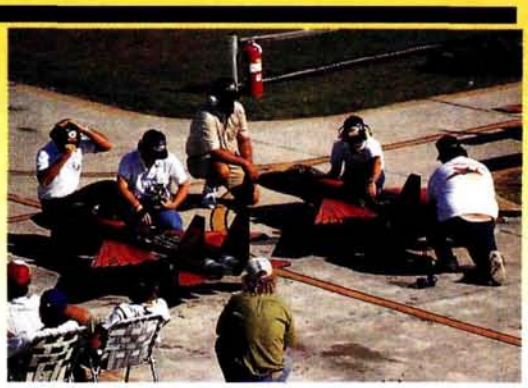








Lynn Jorgensen, a part-time flier for Byron, shows his Byron P-51D, modeled after the CAF Gunfighter P-51D Mustang. The 28-pound plane has a 4.2 Sachs-Dolmar with a Byron four-blade power prop.



The Cloud Dancers prepare the F-15s for exhibition flying. ▶

plane became noticeably louder as that plane neared the crowd in the circling formation. As the aerobatic show continued, Aaron Copeland's *Fanfare to the Common Man* was played over the loudspeakers. That was only the beginning.

The Cloud Dancers International Show Team put on a display of precision flying using Byron F-15 fan jets that astounded and mesmerized the crowd.

Jim Mynning put on a comedy in his modified Super Cub (at one point, he climbed halfway out of the top of the fuselage and was apparently flying with his feet), and he also did an aerobatic routine, dead-stick, from an altitude of 2,000 feet. Clint McHenry, world-renowned aerobatics pilot, flew a full-scale Sukhoi in a grand aerobatic ballet that included some very fast snap rolls and exquisite torque rolls, tail slides and Lomcevaks, his plane often awash in the thick smoke it was emitting.

Striking Back was particularly dramatic in its re-creation of the bombing of Pearl Harbor (in which the full-scale Japanese replicas used in the movie *Tora! Tora! Tora!* flew close-in bombing and strafing passes). The Battle of Midway was then re-enacted with up to eight models flying at a time. The buildup to the simulated dropping of an atom bomb on Hiroshima included a recording of President Roosevelt's statement following that attack, and a re-enactment of the raising of the flag on

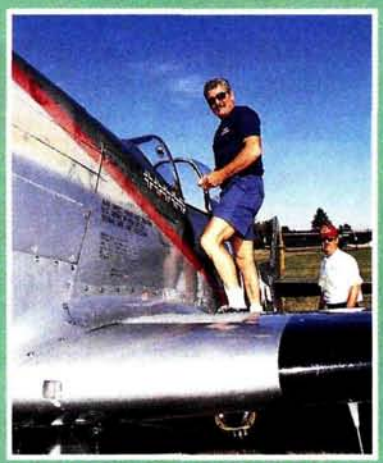
(Continued on page 117)



On the flight line, Ralph Braun flies a 40-percent Extra 230 powered by an Arrow 200 spinning a 24x16 prop. Ralph will be a pilot in the R/C Unlimited Races, in which he will fly a Sky Aviation Mustang using the Arrow.



"I can now better imagine the physically grueling nature of flying a plane like this in time of war."



Retired Brigadier General Reg Urschler stands on the wing of the CAF Gunfighter P-51D Mustang.



The Packard-built V-1650-7 Merlin engine came to life with a staccato roar that changed to a loud, riveting drone that I could clearly hear despite my ear protection. The vibration coming through the frame was of an intensity associated with heavy machinery. It subsided slightly after takeoff and as engine rpm climbed. We cruised for a mile or so at an altitude of several hundred feet, and then, with the throttle opened a bit, we climbed. Gen. Urschler confirmed over the headset that I'd like to see a few maneuvers.

We then did an axial roll, a loop (from 7,000 feet), another axial roll, an eight-point roll and, finally, a barrel roll. The axial rolls were incredibly smooth, with just enough positive Gs to sit comfortably and watch the horizon rotate. We sustained about 2Gs in the barrel roll and slightly more in the loop, which was enough to cause me to start sweating profusely and worry about my breakfast. Although this short hop was only a minor exercise, it was truly an eyeful for me. I can now better imagine the physically grueling nature of flying a plane like this in time of war.

KOMBAT 40

(Continued from page 33)

from radio to radio. At the test site, the Kombat 40 enters a steep power dive from about 800 feet (speeds of 120mph have been clocked), and it pulls out at about 40 feet. In the exercise, the radar homes in on the aluminum fuselage. This may be the only R/C combat plane that also plays a role in the larger defense arena!

The Kombat 40, an airplane of simple and utilitarian design, is a sturdy, highly flyable aircraft that can provide a lot of sport combat fun.

**Here's the address of the company mentioned in this article:*
Airplane Factory, *188 Pineview, Mandeville, LA 70448.* ■

AIRWAVES

(Continued from page 11)

since 1938. One of my more recent models is a "New Ruler" with radio control. This is a replacement for my first gas model, which was a "New Ruler" powered by a Baby Cyclone that was built around 1942. The present model is similar to the old model, including the removable fuselage tray on which I've mounted the radio, servos, battery and fuel tank.

I find the "50 Years Ago" column very interesting. The rest of the magazine is just great. Enclosed is a picture of me with my present "New Ruler" powered by an O.S. 48 4-stroke.

G.A. HUXLEY
Abbotsford, B.C., Canada

(Continued on page 66)

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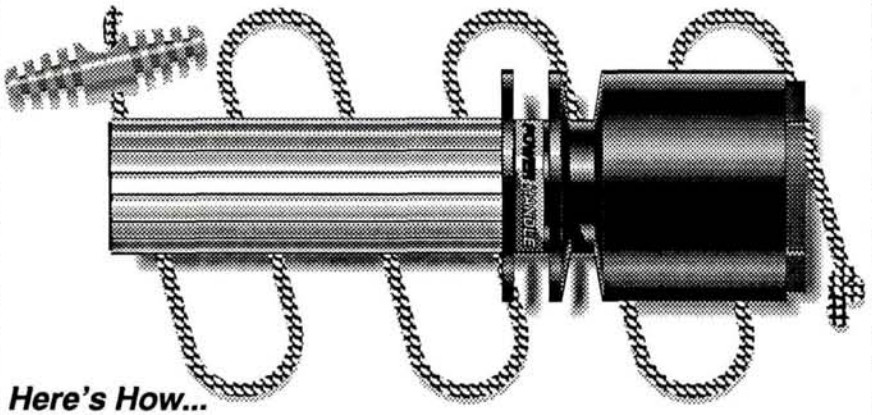
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AIRWAVES

(Continued from page 65)

Gordon, thanks for your kind words. Writing the "50 Years Ago" column is a favorite job here. We didn't see the Cloud Coaster article in the December '41 issue, but we did find a nice design called the "Paragon." This cabin wing gas job also had a wingspan of 48 inches, but it was unique in that it had a full-span slotted-wing. You can see a reprint of these plans in this issue's "50 Years Ago." I hope you find it interesting

Your "New Ruler" looks great. With R/C, these old designs are a dream to fly, and they look wonderful on the wing as well. Thanks for your continuing loyalty over the years. GY

SOVIET MODELING

Thank you for the report of our visit to the WRAM show in your magazine. We hope to cooperate with you in the future. At present, we're studying the possibility of commercial distribution of our quar-

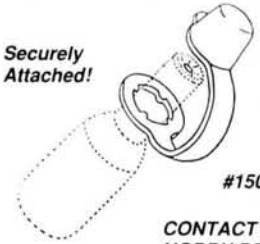
(Continued on page 97)

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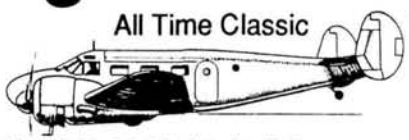
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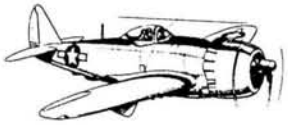
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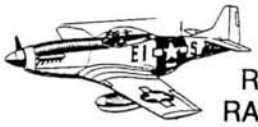
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SPORTS AVIATION

EZ Christen Eagle 40

by RICH URAVITCH

THE CHRISTEN Eagle has been produced in kit form by several manufacturers. The people at Sports Aviation, manufacturers of the EZ line of almost-ready-to-fly (ARF) R/C designs, thought so much of this model that they refined its design and released an improved version—The Christen Eagle 40. With unwavering confidence in its basic design, they stretched the tail moment a little (to enhance pitch stability), thickened the airfoil a skosh, added a little wingspan and increased the empennage's size slightly. They also reproduced the colorful, scale, "feathered" paint scheme.*

PHOTOS BY RICH URAVITCH

CREATION OF THE BIRD

All of the kit's major components come bagged



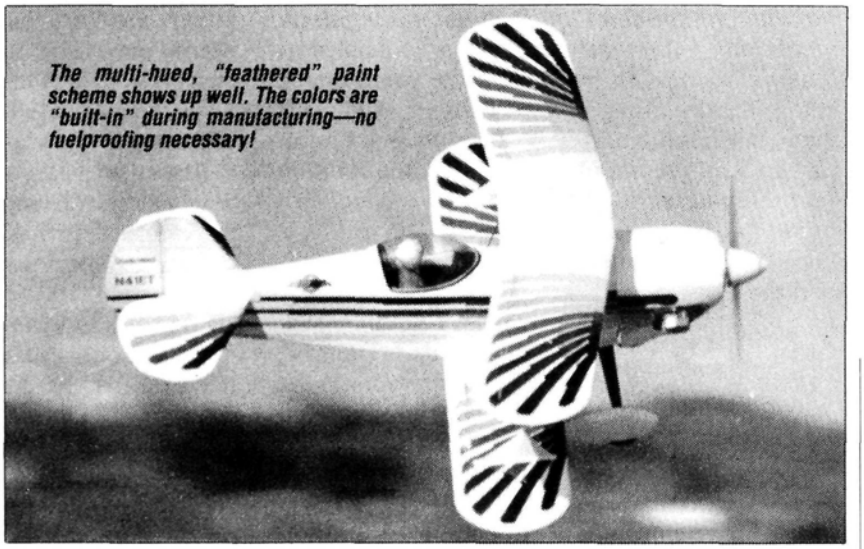
REFINED PERFORMER

and insulated, and all of the sub-components, including the fuel tank, the spinner, the wheels, the control horns, the pushrods and the hardware are included. You have to provide the radio, the prop and the engine. The 15-page instruction booklet has photos, a parts list and a list of the tools and

SPECIFICATIONS

Type: Aerobatic sport plane
Wingspan: 41 inches
Weight: 87 ounces
Wing Area: 502 square inches
Wing Loading: 24.9 ounces per square foot
Length: 35 inches
No. of Channels Req'd: 4 (rudder, elevator, aileron, throttle)
Sug. Retail Price: $399.95
Features: this is an ARF in the EZ tradition with a molded-in, colorful finish, factory-hinged control surfaces and a durable plastic cowl and wheel pants. Nearly all the accessories, e.g., the fuel tank, the spinner, the wheels and the hardware, are included.
Comments: this Eagle is a delightful little airplane that's remarkably aerobatic without being treacherous. Though it's not for novice fliers, it's still very docile when flown slowly and, when properly powered, it delivers outstanding vertical performance.

Christen Eagle 40



The multi-hued, "feathered" paint scheme shows up well. The colors are "built-in" during manufacturing—no fuelproofing necessary!

OTHERS HAVE FLOWN IT AND THEY MARVEL AT ITS VERTICAL PERFORMANCE AND ITS OVERALL MILD MANNERS...

THE EAGLE IS A POTENT LITTLE AIRPLANE!

adhesives that you'll need.

Most of the instructions are clear and accurate, and assembly is divided into sections. The upper and lower wing assembly is first. It's straightforward, but be careful when you make up the joiner for the lower wing; if you assemble it incorrectly, you'll have problems joining the two wing panels.

Always dry-fit all the parts, and make sure that you understand how they're supposed to fit. (When they're right, they'll fit perfectly!) To create a little dihedral, I blocked-up one tip of the lower wing slightly when I joined the panels. This doesn't affect performance; it just eliminates the "sagging" look of flat wings. You don't have to modify the spar joiner or the wing panels, because there's enough "give" in the joiner receptacles to allow the dihedral to be incorporated. The wing-mounting block consists of three pieces of die-cut, 3mm plywood, which you must laminate. Two of them are identical; the other piece goes on the bottom of the stack. (This becomes evident when you install it in the fuselage.)

STRUTTIN' YOUR STUFF

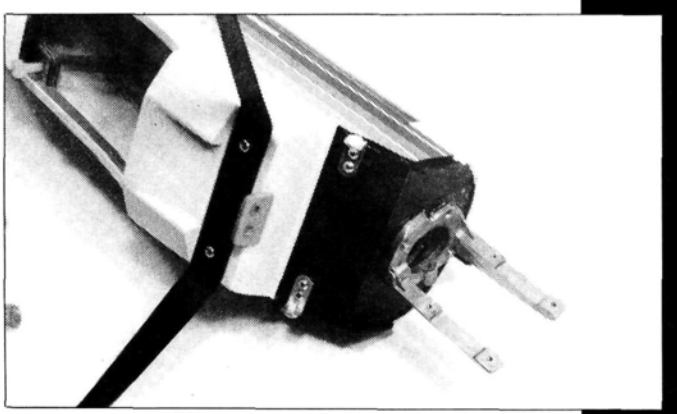
Aligning the wings properly is one of the toughest parts of building any biplane. Not only is the squareness of the wing to the fuselage important, but the angle of incidence is also critical. The bottom wing's incidence is determined by how far it slides into the fuselage saddle. The top wing is suspended above the fuselage by struts, so the length and position of these struts are critical. Bent, tapped, aluminum rods that you screw into place (they only go in one way) are provided. Be sure to trim the plastic cosmetic strut caps flush with the aluminum struts, or you'll get the upper wing's incidence wrong.

Stick with the suggested construction sequence; I learned this the hard way! While things were drying, I thought I'd save time by assembling and installing the fuel tank. Bad move! With the tank installed, it's impossible to reach the forward cabane strut attachment screw. So, out came the tank, in went the cabane, and back in went the tank.

GEARS, TANKS AND POWERPLANTS

All the landing-gear parts are formed or bent; you just assemble them. The 2-inch tires are housed in vacuformed wheel pants that are attached to a spring-steel strut. To determine the proper position of the pant-attachment screw, which works with the axle, block-up the airplane so it's level on your workbench, rotate the pant until it's level, and mark the screw's position through the hole in the gear strut. (Not much of the tire is visible outside of the pant!)

When you assemble the fuel tank, consider using a three-line installation rather than the two-line shown, especially if it isn't easy to disconnect the feed line. I use an Enya* .60 4-stroke engine, which has a "shoehorn" fit that positions the fuel

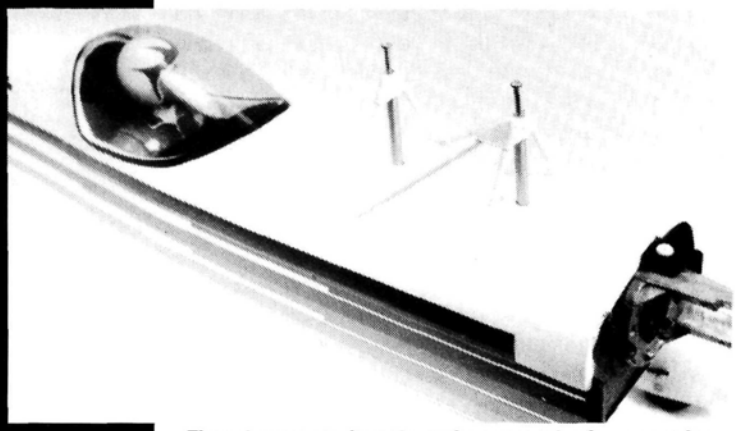


Here you can see the landing-gear mount, the cast-metal engine mount and the cowl-attachment brackets. To provide more support for the cowl, the brackets are in this position rather than that specified in the instructions.

Christen Eagle 40

AFTER 30 FLIGHTS, THE EAGLE IS GOING INTO ITS SECOND SEASON, AND IT'S STILL 100-PERCENT ORIGINAL

connection on the carburetor, making it virtually inaccessible. My fill line now exits the top of the cowl, and the vent dumps the overflow straight down through the aft opening in the bottom of the cowl.



The cabane struts form the major support for the upper wing. The plastic caps are cosmetic but, to preserve the incidence angle, trim them flush with the tapped metal rods.

The engine mount consists of a cast mount that's drilled and tapped to accept a pair of mounting plates that you attach to the engine first. Spacers are also provided to shim shorter 2-stroke engines farther from the firewall.

ELIMINATING THE STABBING PAIN

I've built and reviewed many EZ kits, and I've found it easier to install the elevator and rudder pushrod *before* I glue on the tail feathers—especially the stab mount. The Eagle's instructions don't suggest this, but I still recommend that you install the pushrods first. The rest of the radio installation is discussed briefly.

CONTROL HORNS

The Eagle uses a variety of control horns that are attached to the control surfaces with screws, and the surfaces are reinforced to prevent the horns from breaking loose. The elevators are reinforced with plywood, and to inset it, remove some of the covering and the foam sheet to expose the balsa core. The rudder has a small plastic plate to support the horn and receive the screws. The four ailerons are interconnected, so each one is attached directly to a stamped metal horn. There are "left" and "right" horns, so match them prior to installation.

FINAL FEATHERS

A Williams Bros.* $2^5/_8$-inch pilot fits nicely and can be painted to resemble your favorite celebrity. Add the canopy to shut him in forever, and you're ready to finish this project.

You probably noticed the large, colorful Mylar decals that match the "built-in" decorations on the model's surfaces. What you probably didn't notice is that the decals aren't die-cut; you have to cut out all 80 little stickers!

OUT OF THE NEST AND INTO THE AIR

I checked the CG and the control throws. The 4-stroke engine made the Eagle a little nose-heavy when I balanced it at the recommended location of $^1/_8$ inch forward of the lower wing's leading edge. This didn't bother me; I usually prefer it with any new airplane. Fine-tuning can come later. I set up the control-surface throws as recommended.

With a 41-inch wingspan (smaller than most) and a 12x8 prop (driven by a 4-stroke .60) hanging off its nose, I hoped that Sports Aviation's faith in the new, improved version wasn't unfounded. I let the Enya warm up, and I checked the idle and the throttle response. Everything seemed fine. When I held the airplane vertically and ran it up to full throttle to check the needle setting, I discovered that the Eagle would hang on the prop, and it only needed occasional guidance to keep it that way! Imagine, a VTO Eagle!

I throttled back, set the Eagle on the runway, took a deep breath and applied the power. Acceleration was instantaneous, as was the torque effect that pulled the nose to the left. Right rudder corrected this immediately, and the little bird was airborne in 50 feet. Pulling back on the stick produced a positive climb at about a 60-degree angle. I reduced the throttle setting to about half and flew around to trim the airplane—a touch of right aileron and two clicks of up-elevator. Using the recommended throws, elevator response was excellent, but aileron was somewhat soft. Rudder was also fine and more than adequate to maintain a reasonable knife-edge.

With the 4-stroke .60, the Eagle does torque rolls in vertical if they're entered properly, and I've even had it hanging on the prop flying sideways when there was a little wind. I have to carry the power on final until I've made the runway. The plane won't stall/snap on landing; it just sinks rapidly when power is reduced.

If you *fly* it onto the runway, landings are beautiful. If you bounce onto it, the spring steel gear will bottom and throw the little bird into the air again. If most of

(Continued on page 113)

ENGINE EVALUATION

WEBRA SPEED .61F ABC

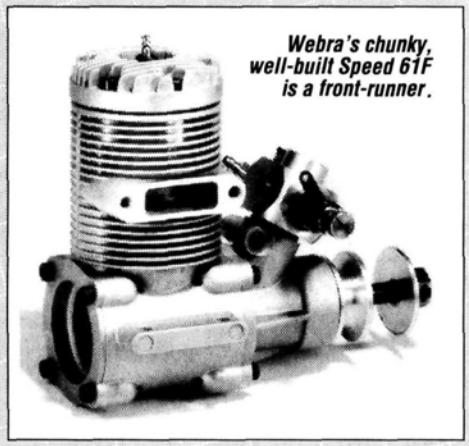
by MIKE BILLINTON

A reliable pattern performer

THE GERMAN/AUSTRIAN model engine manufacturer, Webra, offers 53 engines with a variety of capacities from the diminutive .1ci Speedy 2-stroke to the 2.1ci Bully .35. This surprisingly large range includes engines for virtually all types of model: cars, boats and airplanes (sport, ducted-fan, large-scale aerobatics, etc.). It also includes the unique, .40ci, .60ci and .80ci rotary-valve 4-strokes.

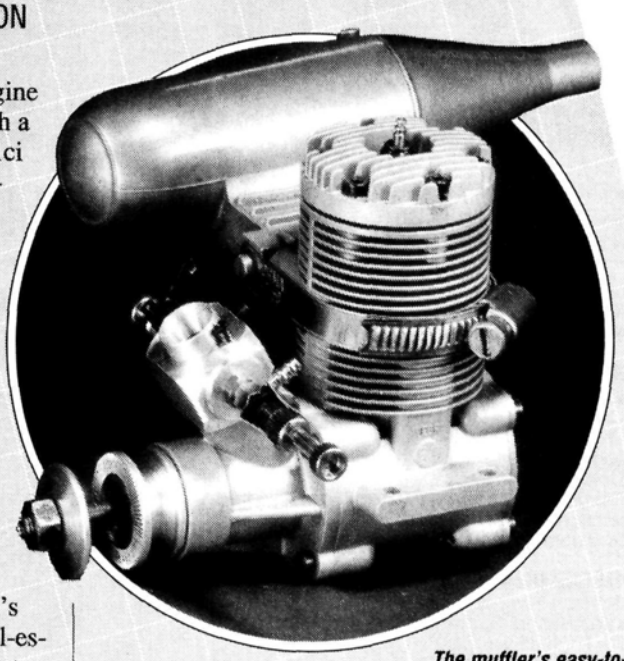
This month's test engine—the Webra Speed 61F—is a typical, mid-range .61ci machine. It's one of nine types of .61 (10cc) engine (including three long-stroke versions) that are produced by this energetic manufacturer. This front-induction/side-exhaust engine's performance lies midway between that of the well-established, cross-flow, sport, 2-stroke, ringed-piston .61 (with 1.45hp at low rpm) and the racing .61 rear exhaust/rear induction engine (with 2.85hp in the 20,000rpm area). The Speed 61F's natural arena is pattern flying, in which quiet engines with moderate rpm are required (FAI and AMA regulations). Although the trend in competition pattern flying is to use long-stroke, front-intake, rear-exhaust engines, many "sport" pattern fliers use engines such as the 61F to fly a variety of pattern-capable planes. With this in mind, I undertook these tests.

The engines used in pattern aircraft must be reliable because of the many hours of practice that are required to be competitive, so Webra's reliable engines have been popular. The Speed 61F survived an unusually long test session, so its construction and metallurgy appear to be good.



Webra's chunky, well-built Speed 61F is a front-runner.

Most modelers will be familiar with this engine's layout: Schnuerle porting of the two side transfers; single boost and single exhaust; front induction by means of the crankshaft; a plain aluminum/brass/chrome liner and piston that are set inside a well-finned, die-cast crankcase, from which you can remove the front housing and the rear cover.



The muffler's easy-to-use, effective fastener is also used for the tuned-pipe assembly's steel manifold. Just take care not to overtighten it.

The Speed 61F's exhaust timing is a modest 150 degrees for a reasonable tuned-pipe response at an expected low rpm (between 9,000 and 12,000). Its effective compression ratio is a "soft" 7.5:1. Its fairly normal 200-degree crankshaft induction timing and its small 7.8mm bore carb complete a package that's likely to be suitable for pattern events—mild and flexible.

Webra recommends using its Quiet tuned pipe, which, unlike many side-exhaust pipes, is quick and easy to fit. (Just don't overtighten the strap-type fastener, or you might distort the cylinder.) In its out-of-the-box length, the pipe's peak resonance is around 13,000rpm. The aerobatic scene has, however, moved on since Webra first offered pipes of this length. Out of necessity, i.e., to reduce noise, current operations are now nearer to 9,000rpm. Lengthening the manifold by 4 inches is now advisable because, as the power graph shows, it pushes the resonance down to this rpm range.

PERFORMANCE

Unlike Webra's earlier hard-steel liners and ringed pistons, the Speed 61F's aluminum/brass/chrome liner/piston combination doesn't need an extended break-in, so I started the routine propeller rpm checks early. To ensure that most readers will be able compare their engines with this test, I used a variety of propellers.

As you can see, the Speed 61F has quite an rpm range, and the relatively "soft" design parameters

PHOTOS BY MIKE BILLINTON

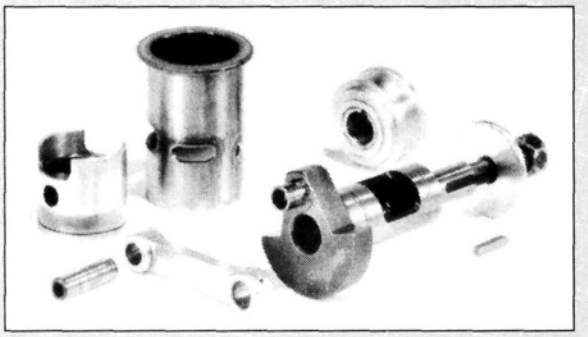
mentioned earlier enable it to operate easily at either end of its range.

Test 1. Open Exhaust. Fuel: 5 percent nitro/20 percent ML70 synthetic oil/75 percent methanol. Plug: OPS 250 R/C.

The open-exhaust test provides findings that help us to compare this engine's performance with those of others. It also prepares the engine and the operator for the more meaningful tuned-pipe tests to come!

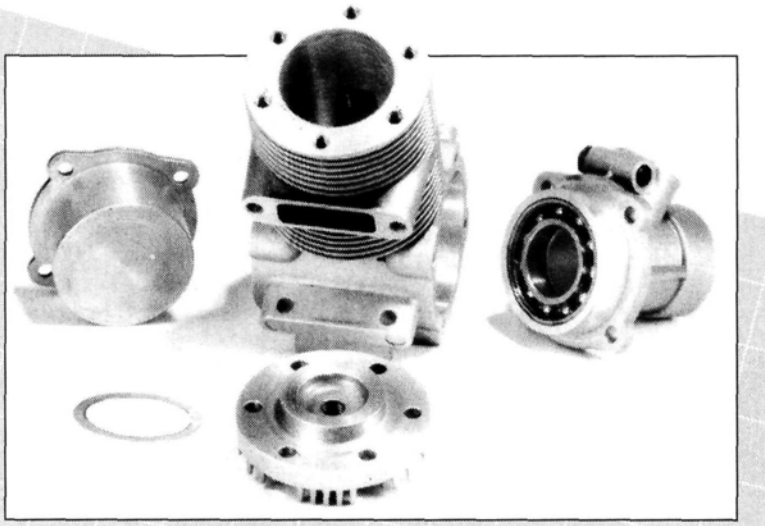
The results confirm the wide rpm performance band that's available from modern, Schnuerle-ported, 2-stroke model engines. They also show that rpm can be harnessed effectively and selectively to produce the best power for particular models.

Maximum torque was just below 11,000rpm, and this would allow good performance with the heavy-load propellers often used for pattern flying. Using a tuned pipe of the appropriate length would enhance torque at that low rpm.



The relatively small (10mm) induction bore within a large, 17mm o.d. crankshaft ensures reliability and durability. After a long test session, the ringless piston crown was evenly worn. This indicates a good, symmetrical heat transference to the chromed-brass liner.

Test 2. Webra standard muffler. Fuel and plug as in Test 1.



Here, you can just see the cylinder head's two-angle squish band. The crankcase employs two side transfers and a single-boost passage. An 11-ball main bearing fits around the large 17mm crankshaft.

In this form, the Speed 61F exhibited a normal reduction in torque, horsepower and fuel consumption, but with a slight resonance effect that caused a slight torque loss between 8,000 and 10,000rpm.

Test 3. Webra Quiet tuned pipe at 360mm. Fuel and plug as in Test 1.

This standard, out-of-the-box setup caused maximum resonance to occur at a slightly higher rpm than is currently the norm in pattern circles, i.e., where sound reductions are sought.

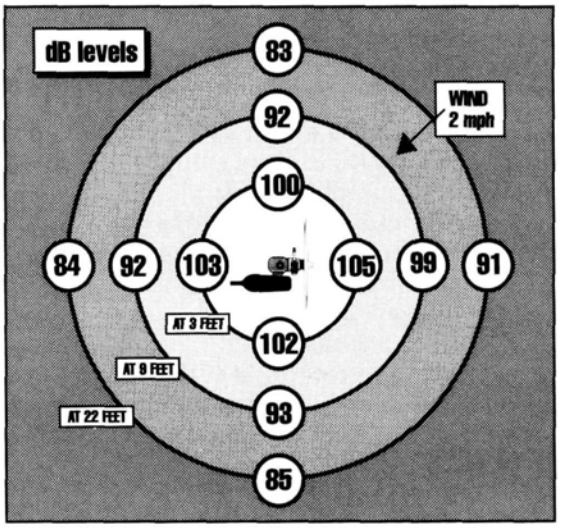
It's interesting that Webra claims this engine produces a 1.96hp at an implied (though, not specified) peak of 16,000rpm. This must have been achieved with a shorter pipe—probably around 320mm. If best pipe resonance occurs at lower rpm, the maximum figures achieved in this test are to be expected

Test 4. Webra pipe lengthened to 460mm. Fuel and plug as in Test 1.

To bring the Speed 61F's rpm down into the range that's currently used by sport pattern pilots, I used previous findings to guess how much I should lengthen the pipe header.

SOUND LEVELS—dB

Engine	Webra Speed 61F (RC/ABC) with side exhaust
Equipment	Webra 460mm Quiet tuned pipe
Fuel	5 percent nitro; 20 percent ML70 oil; 75 percent methanol
Temperature	52°F.
Humidity	75 percent
Propeller	12x12 APC
Mean rpm	9,200
Engine position	3 feet above ground
Sound Meter	Radio Shack's 33-2050 unit set at 38 inches above the ground and pointing toward the nearest sound, i.e., propeller or muffler outlet. Three distances were used—3 feet, 9 feet and approximately 22 feet.

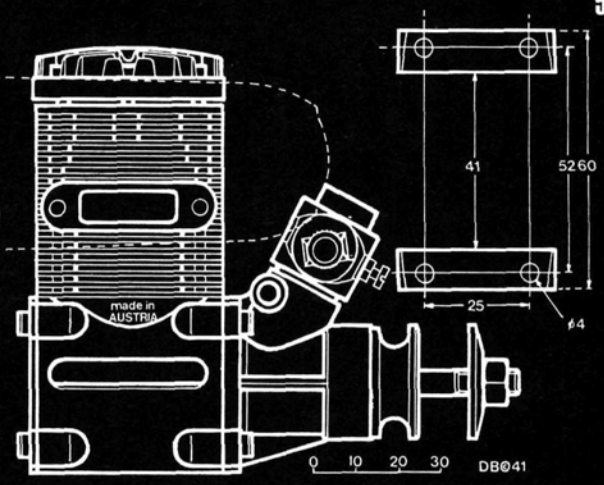


SPECIFICATIONS

55% OF FULL SIZE

WEIGHTS & DIMENSIONS

Capacity 0.6047ci (9.921cc)
Bore 0.9445 in. (24mm)
Stroke 0.863 in. (21.93mm)
Stroke/bore ratio 0.914:1
Timing periods Exhaust - 150°
Transfer - 122° (angled up 10°)
Boost - 116° (angled up 50°)
Front Induction:
—Opens - 37° ABDC
—Closes - 57° ATDC
—Total Period - 200°
—Blow-down - 14°
Combustion volume 1.05cc
Compression ratios Geometric - 10.45:1
Effective - 7.52:1
Exhaust-port height 0.267 in. (6.79mm)
Cylinder-head squish 0.020 in. (0.51mm)
Cylinder-head squish angle 4° and 7°
Squish-band width 0.164 in. (4.17mm)
Carburetor bore 0.307 in. (7.8mm)
Crankshaft diameter 0.669 in. (17mm)
Crankshaft bore 0.393 in. (10mm)
Crankpin diameter 0.2745 in. (6.98mm)
Crankshaft nose thread 0.247 in. x 28 TPI (1/4 UNF)
Wristpin diameter 0.236 in. (6.01mm)
Connecting-rod centers 39mm
Engine height 3.88 in. (98.6mm)
Width 2.36 in. (59.9 mm)
Length 3.66 in. (93mm)
Width between bearers 1.62 in (41.2mm)
Mounting-hole dimensions 57.1x25x4mm
Exhaust-manifold bolt spacing .. 34x4mm
Frontal area 6.7 sq. in.
Weight Bare - 17.4 oz. (492g)
With muffler - 20.6 oz. (586g)
Crankshaft weight 3.35 oz. (96g)
Piston weight 0.40 oz. (12g)



RPM on standard fixed-wing propellers:

	Open Exhaust	Standard Muffler	Webra 360mm t/pipe	Webra 460mm t/pipe
18x7 Mastro	4,603	4,400	4,273	4,228
18x8 Top Flite	—	4,765	4,276	4,470
15x8 Graupner	—	—	—	6,944
14x7 Graupner	8,090	7,968	8,060	9,020
12x12 APC	8,265	8,190	8,672	9,510
14x8 APC	8,640	8,295	8,675	9,975
11.5x8 MacGregor	—	8,843	9,339	9,976
11.5x10.2 Yoshioka	—	—	11,486	10,441
13x6 MK	10,510	9,980	11,625	10,510
12x6 Graupner	12,100	11,751	12,885	11,742
11x6 Graupner	13,690	13,140	14,705	—
11x7 APC	13,716	13,127	13,962	12,810
10x6 MK	14,848	14,248	14,939	—
10x6 APC	16,527	15,658	15,894	—
10x4 Zinger	17,344	16,411	16,707	—
9x4 APC	20,654	18,250	18,324	—

PERFORMANCE

Max. b.hp 1.86 @ 13,007rpm (Webra standard 360mm Quiet tuned pipe/5% nitro)
1.73 @ 17,460rpm (open exhaust/5%nitro)
1.43 @ 9,648rpm (460mm Quiet tuned pipe/5% nitro)
1.41 @ 15,053rpm (standard muffler/5% nitro)
Max. torque: 149 oz./ins. @ 11,518rpm (360mm Quiet tuned pipe/5% nitro)
147 oz./ins. @ 9,648 rpm (460mm Quiet tuned pipe/5% nitro)
121 oz./ins. @ 10,960rpm (open exhaust/5% nitro)
108 oz./ins. @ 6,200rpm (standard muffler/5% nitro)

Performance Equivalents:

b.hp/ci 3.07
b.hp/cc 0.1875
Ounce inch/ci 246.4
Ounce inch/cc 15.02
Ounce inch/pound 137
Gram meter/cc 10.73
b.hp/pound 1.71
b.hp/kilo 3.78
b.hp/square-inch frontal area 0.278

Manufacturer: Webra Modellbau GMBH, Weidenberg, Germany.
U.S. Distributor: Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61820.

I added a 100mm piece of aluminum pipe that has an inside diameter equal to that of the existing header pipe, and I made connectors using appropriate silicone exhaust tubing. As I hoped, this caused full resonance to appear at a conveniently low 9,648rpm, where a high torque of 147 ounce/inches was available. This is sufficient to drive a propeller like the 12x12 APC.

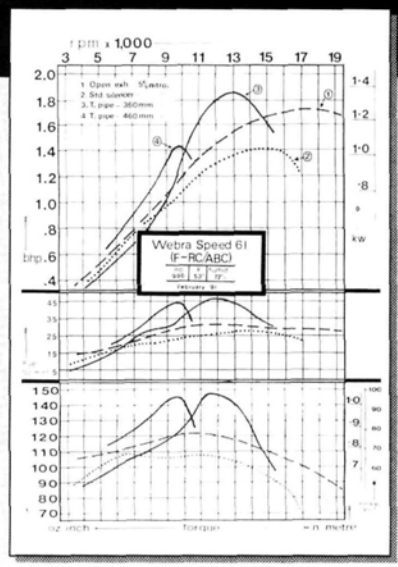
SOUND LEVELS

Thinking that a 460mm Quiet tuned pipe and a 12x12 APC propeller would probably be used frequently on flying fields, I took the relevant decibel sound-level readings with this setup. I discovered that another slight reduction in rpm would be necessary to meet the AMA's requirements (90dB from a distance of 9 feet).

IDLING SPEED

In this test, I again used the 460mm pipe and the 12x12 APC propeller. I used a pressure feed from the pipe to the fuel tank, and this made it easy to achieve 1,900rpm by adjusting the secondary fuel needle in the Webra's twin-needle carburetor.

(Continued on page 114)



Pattern experts





▲ *Steve Helms and his Mystery—definitely one of the best-looking planes this year.* ■ *Inset (top right): the newest YS 1.20, flown by Steve Helms, has a plenium chamber and larger valves. It was very strong and quiet; in my opinion, of the many 4-stroke models that demonstrated exceptional power, this one was clearly the quietest.*

▼ *National champ Chip Hyde with Jekyll. After a disappointing 4th-place finish last year, Chip was prepared to take all the marbles this year.*



'91 nats

by NORM STAUB

THIS YEAR, AT the AMA Nationals, U.S. pilots captured the top three spots in FAI competition; last year, only one U.S. pilot made the top three. It's a tribute to their consistency, as these are the same pilots who earned the top three spots at the June 1991 USA team selection, and they represented the USA in the 1991 World Championships in Australia.

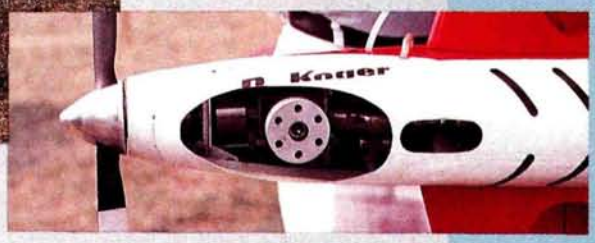


◀ *Steve and Pat Stricker with their original-design Excalibur. Team Stricker finished 8th in FAI.*

and preferred machines



▲ *Here's my SL-1 before the second round of the FAI finals. Just before the flight, I almost passed out because of the heat, but I completed the round.*



▲ *With its belt prop-drive system, Dean Koger's distinctive-sounding Webra .61 2-stroke clearly makes horsepower along with the best of the current 4-strokes. Dean placed 6th in FAI.*



▲ *Geoff Combs's SL-1 takes to the skies in the first of the two FAI fly-offs.*

▼ *Ivan Kristenson proudly displays his Summit III. Ivan flew to 4th place in FAI.*



◀ *A few biplanes made appearances. Thirteen-year-old Jerald Cheney of Bloomfield, IA, flew this Goldberg Ultimate in Expert Turn-Around. It's powered by an O.S. 1.20 4-stroke turning an APC 15x8 prop; it has retractable landing gear; it uses no transmitter control mixing; and it weighs 8 pounds, 13 ounces. Jerald flew it to a respectable 21st-place finish. Site 2, flight lines C and D, is in the background.*

PHOTOS BY NORM STAUB

AIRWAVES

(Continued from page 97)

publication becomes available in this country. TA

HOOKED ON MODELING

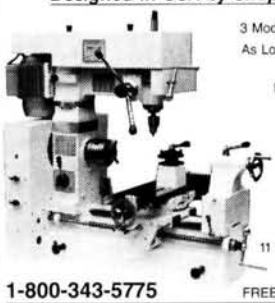
R/C model building has recently entered my life, and I'm happy to report that I'm firmly hooked. I've been a static model builder for almost 20 years, and the transition into flying models is very exciting. I've built a trainer and, recently, I started a Top Flite P-39 stand-off-scale kit to help develop my building skills.

Legacies from my static model days are my love of WW II-era warplanes and my obsession with detail. Although I'm building the Top Flite kit with as much scale appearance as possible, I consider this to be a learn-ing experience and a logical step towards mastering the art. I plan on attempting a scale aircraft for my next project.

I've discovered that the Airacobra isn't nearly as well-known as aircraft developed later in the war. Consequently, a relatively small number of stand-off-scale kits are available, and I've yet to find a scale kit or scale plans for the P-39.

(Continued on page 112)

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Specifications:
Wingspan: 65"
Wing Area: 727 sq. in.
Radio: 4 Channel (5 Channel for Retracts)
Flying Weight: 6 - 7 lbs.
Motor Range: .60 to .90 2-Stroke, .65 to .90 4-Stroke
Kit # 174

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'91 nats



Greg Marsden of Canada brought his original Legend. It placed 10th in FAI.

The contest site was the Mid-America Air Center—a small airport between Lawrenceville, IL, and Vincennes, IN. The weather was generally hot, with temperatures in the 90s, and there was about 60-percent humidity. Two hundred and eighteen pilots competed in five classes; FAI had the largest turnout at 77.

Let's examine some of the details:

• **Sportsman Class.** Bill Hetherington of Norman, OK, flew to a narrow 5-point victory over Bob Smith of Cincinnati, OH, with Miguel Munioz of Portchester, NY, not far behind. Jonas Pharr of New Iberia, LA, won two of the six rounds, but his other scores were only good enough to give him a 4th-place finish.

• **Advanced Class**. Winner Ronald "Roscoe" Segura, of New Iberia, LA, had a quite distinct 50-point margin over Kirk Gray, of Florence, SC, who was followed very closely (less than one point) by Wendell Dietz of Baton Rouge, LA. Incidentally, Roscoe won the 1990 Nats Sportsman Class.

• **Expert Turnaround** was very tight, with Danny Peterson of Monticello, NY, squeaking by Jeff Powell of Fort Worth, TX, by 6 points. What made this class different was that Powell flew his own design—a biplane called "Lady's Fancy II." A biplane isn't generally a pilot's first choice in R/C pattern, but Powell did a good job with this one.



Ed and Danny Paterson—a father quite proud of his son becoming National Champion in Expert.

Tony Stillman of Pensacola, FL, finished 3rd in this class. All pattern fliers out there should note that Peterson was victorious in only one of the six rounds, but he flew well enough throughout the contest to win his class.

• **Masters Class** had some classic head-banging with winner Larsen Anderson of Murfreesboro, TN, followed very closely by Donald Szczur of Huntsville, AL. Each pilot won three of the six rounds he flew and had comparable scores on the others. Donald Apostolico of Arlington, TX, finished 3rd. One interesting note about this class: Dave Lockhart of Absecon, NJ, lost his motor part way through both his first *and* second flights; the best four scores were kept, so it can be concluded that he felt some pressure on his third flight. It seems quite creditable that Dave finished 4th in his class.

FAI FORMAT

The FAI Class format was different from that of the other classes. The first four rounds were used to pick the best fliers, who then competed in a two-round final. The top 20 Americans and anyone from another country who finished in the top 20 were selected. Thus, 24 pilots out of the total 77 made the final cut. Some very good pilots didn't make the cut; that only reinforces the fact that, every year, we get more and more high-quality fliers.

For those of you who are unfamiliar with the FAI Class, this is the fourth year that FAI has involved the same sequence of maneuvers, and deciphering who was flying better than whom was a monumental task for the judges. Because this *was* the fourth year in which this sequence has been used, and because pilots were so proficient, the overall flying in the finals was excellent.

Next year, it should be a little easier for the judges because different sequences of maneuvers will be flown for the qualifying rounds and the finals. Also, the sequences will be different from those presently being flown.

EQUIPMENT AT THE NATS

Radio equipment was predominantly by Futaba, followed by JR Propo, Airtronics and miscellaneous others. APC propellers were definitely used by most of the competitors, as were Tru-Turn spinners. It was quite interesting to see that many of the aircraft flown had been built from R/C City kits. R/C City now produces many more pattern designs—possibly more than anybody out there.

The hottest lick in

THE TOP 10 IN FAI

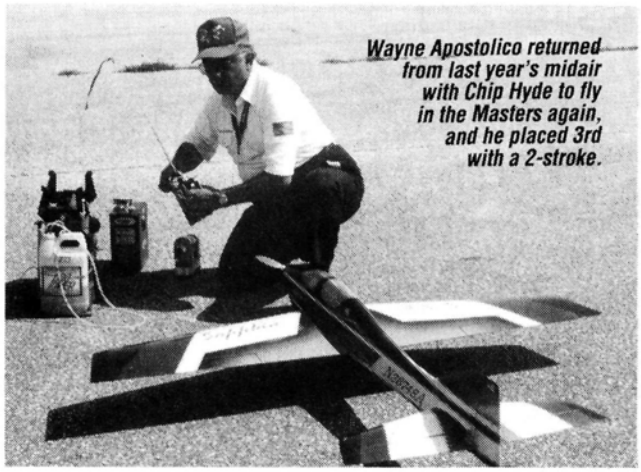
1	Chip Hyde	Yuma, AZ
2	Dave Von Linsowe	Mount Morris, MI
3	Bill Cunningham	Tulsa, OK
4	Ivan Kristensen	Ontario, Canada
5	Quique Somenzini	Rio Cuarto, Argentina
6	Dean Koger	Xenia, OH
7	Geoff Combs	Pickerington, OH
8	Steve Stricker	Baltimore, MD
9	Dave Patrick	Chicago, IL
10	Greg Marsden	Ontario, Canada

'91 nats



Quique Somenzini's original 4-stroke design, "DeSafio," weighed only 7.6 pounds. The plane, which had two servos on each aileron, finished 5th in FAI.

equipment this year was the YS 1.20 4-stroke. More 4-strokes were flown at this year's Nats than ever before, and I think that in the future, we'll see even more. Why? There are several reasons. The 1.20 4-stroke makes more power for its size and weight than a .60 2-stroke. Also, the 4-stroke has enormous low-end torque (making it very powerful at low rpm), but a 2-stroke achieves its maximum performance at higher rpm. This means that the 1.20 4-stroke can be loaded down with a large-diameter, heavy-pitch prop and still produce power. This is evidenced by the slew of large airplanes that competitors currently use. Many of the aircraft types flown at this years Nats are 15 to 25 percent bigger than they were just three years ago. Dave Von Linsowe flies an aircraft with approximately 1,155 square inches of wing area—something that most would have deemed impossible a few years ago.



Wayne Apostolico returned from last year's midair with Chip Hyde to fly in the Masters again, and he placed 3rd with a 2-stroke.

Using a large-diameter prop with the 1.20 provides another benefit, and that's "braking action" on downhill vertical lines; it helps to provide a more constant speed presentation—something everyone in pattern is working toward. A 4-stroke with an exhaust setup similar to that of a 2-stroke (header and pipe) is definitely perceived to be the quieter of the two when, in fact, if both engines were measured by a dB meter, the 4-stroke would probably be louder. This is owing to the pitch-sensitivity of the human ear. Without stepping on anyone's toes, I wonder if we should consider a different type of noise measurement for 4-strokes. (Perhaps a "frequency factor" should be considered.)

CONTROVERSIAL FEEDBACK

The pattern format this year required the contestants to be there for the entire week (Monday through Friday), unlike prior years, in which a particular class flew in three days. The problem with this format is that most pilots only flew once on any day, thus dragging out the day and the week. Most pilots that I spoke with seemed to prefer the older format.

Also, for the first time, all pilots were required to work half a day on event-related duties. When CD Greg Frohreich relayed this at the pilots' meeting before the contest, he received a less-than-positive response. It was suggested by many that, in the future, the entry fee be increased enough to have some Boy Scouts or high school kids act as workers.

Judging at this event is always a controversial subject, but some suggestions seem to make a great deal of sense:

- Judges shouldn't be allowed to know who the pilots are (no names on the score sheets), and pilots shouldn't be visible to the judges. This may help to eliminate some "halo" effects.
- Scores shouldn't be posted until the contest is over. This way, the judges can't be influenced by preliminary results.
- Judges should be evaluated, and extremely biased judges should be excused from future Nats.

A NEW ERA

Pattern flying is an ever-changing sport, and it's currently in a period of dramatic evolution. Five years ago, many right-wingers (pun) wouldn't consider flying competitive styles similar to those of full scale competition (maneuvers done within an imaginary "box"). Starting in 1992, all R/C pattern flying will take place inside a "box." What does all this have to do with the Nats? In 1992, we'll move forward to a new era of flying: All Turnaround.

NATIONAL SOCIETY OF R/C AEROBATICS

If you're a pattern flier, or an individual who wishes to stay current with trends in pattern, it might pay to join the NSRCA. The NSRCA publishes a monthly newsletter with a wealth of information that ranges from building tips to guides for the performance of complex aerobatics, and it contains input from different parts of the country. Dues for one year are $20; send your check to Suzi Frohreich, P.O. Box 41310, Phoenix, AZ 85080.

The 1991 Nats was a great week of fun and competition for all who participated. Many thanks to Greg Frohreich (contest director), the U.S. Pattern Judging Association president Jim Parker and his crew, Mike and Vicki Lauman (computerized scoring) and all the others who made the event a success. ■

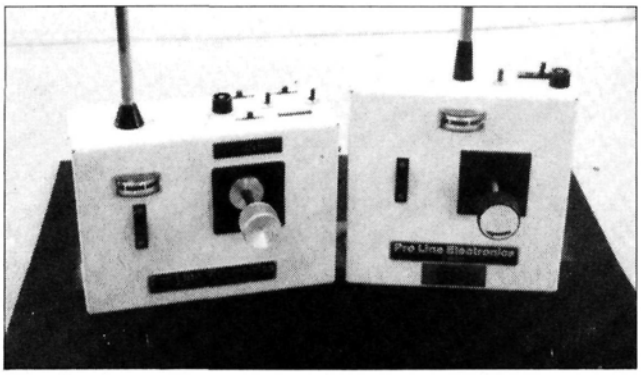
GOLDEN AGE

OF RADIO CONTROL

by HAL DeBOLT

Proline radios: ahead of their time

ASK AND YOU shall receive. It's true! I recently asked for info about Pro-Line and E-K systems. Unfortunately, I still have nothing on E-K, but I received a wealth of details about Pro-Line.



A Pro-Line Competition transmitter with the less costly Cadet transmitter.

Rich Meland of Lakeland, FL, just happened to be in his shop when he read my request. Looking for a dumping place for long-saved Pro-Line printed material, he gladly passed it on. Like most Pro-Line users, his best recollection of Pro-Line's system is the years of trouble-free use that it gave.

Not to be outdone, Chester Kramarski of Cumming, GA, also answered with catalogues, ads, etc. He was apparently a latecomer to Pro-Line, having bought his system in 1978. Like many others, he still uses his and has combined the transmitters with receivers and servos made by other companies. His latest combo is an RCD receiver and Futaba servos.

PRAISE FOR PRO-LINE

This will be one of my favorite reports because Pro-Line products have served me flawlessly for so many years.

Like competitors in most sports, R/C contest fliers consider it an advantage (or a must?) to use the finest equipment available. During the '60s, the comp scene was almost completely dominated by black and gold boxes—Orbit and Kraft were state-of-the-art. As good as these systems were, there were occasional failures; for whatever reason, components would give up the ghost. Beginning in about 1970, a new kid on the block showed up with a white box that promised complete reliability and offered several new features.

Almost overnight, transmitter impounds had a much lighter color! The list of early users represents a who's who of R/C and includes winners such as Jim Whitley, Jim Martin, Ron Chidgey, Bob Violett and Nats Champ Norm Page. This continued for many years, and then economic changes created a completely different picture.

The Pro-Line concept was the brainchild of visionary electronics engineer and R/Cer Jim Fosgate, of Phoenix, AZ. Jim could look at electronic equipment, see its shortcomings and visualize what was needed. He though that nothing but the finest was good enough to control our precious models! With that always in mind, he developed a system from scratch—from the circuits to the components and mechanics, right through to assembly. As we now know, his persistent efforts led to the establishment of Pro-Line. Of course, the finest doesn't come cheap; you have to pay for excellence.



A very early Pro-Line Competition series system—everything you needed!

Production began in a small way, with Jim supervising a very small shop. He took his desire for perfection from the concept stage through to production control. The products that left the shop were just as he had visualized them. Demand came so quickly that production had to be increased. There were delivery delays, but when you—at last!—received your system, it was always just what you hoped and expected it would be.

TIMELY TAKEOVER

By the '70s, the computer explosion was obvious, and Jim went to work for one of the large corporations. Fortunately for R/C, as far as products were concerned, nothing changed at Pro-Line; high quality was maintained. The demise of the company was probably caused by the Japanese invasion—just as with so many other of our fine American companies. Pro-Line, however, didn't really die; Ace R/C took it over and still offers some of its equipment and services.

As an aside, let me give you an indication of the



The very familiar Pro-Line logo.

value Pro-Line offered. In the '70s, I operated an R/C "service station," and I thought I should add Pro-Line products to those I serviced. I consulted the Pro-Line people, who said, "What for? We seldom have requests for service; doubt if you'd find it viable." That proved to be true; apart from a few checkups and/or rare crash damage, Pro-Lines were rarely in the shop.

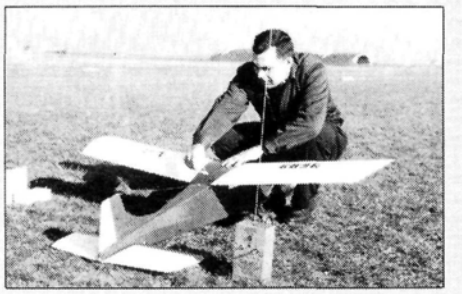
DUPPLE DECKER AND VRCS

How about this coincidence? Before my recent discussion about early biplanes reached you, Col. Bob Mosher of San Antonio, TX, sent info that relates directly to what I wrote.

The discussion of Babcock R/C awakened the colonel's memory of his first R/C experience. Stationed in Germany, after ordering a Babcock 3-channel system from the States, he joined an R/C club that had been started by a few locals. While waiting for it, he built an LW Cruiser, thinking it would suit the Babcock, and he powered it with a Fox .29.

When the Babcock eventually arrived, its weight frightened him. Having decided that the stock Cruiser would never carry it (its batteries alone weighed 1 pound!), he decided to increase its wing area—but how? With the Cruiser already on hand, his solution was to add a second wing, simply by mounting an LW Trainer wing on the bottom of the Cruiser. Now, where have we heard of that? Here's a fellow R/Cer who was across the big pond in Germany and had the same idea that we had in good old Buffalo, USA. I've already told how successful the modification was for us; it was the same for Bob Mosher. Is nothing sacred?

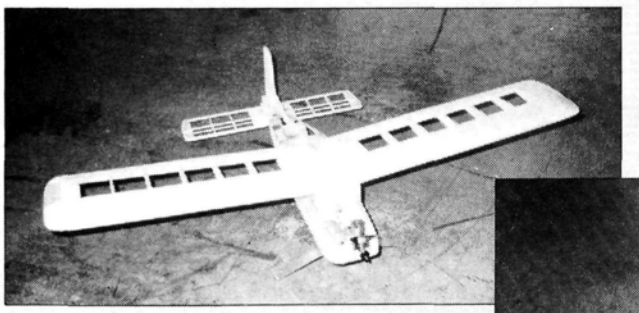
Remember he was a beginner, but believe this: he and his double-wing Cruiser went on to win the USAF European Championship as well as the prestigious German Bavarian Championship. Bob is still active in R/C.



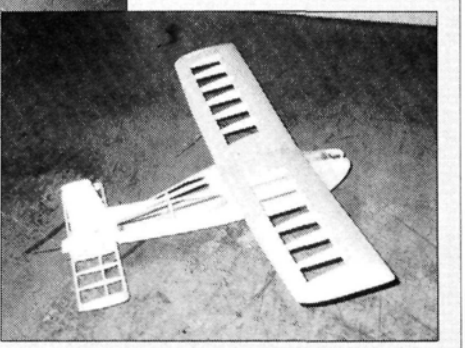
Col. Bob Mosher straps the wing onto his Babcock-controlled LW Cruiser in '50s Germany. He quickly made a bipe out of it to carry the radio's unexpected weight.

VINTAGE INGENUITY

If you're into the Vintage R/C Society, you need an OT R/C plane. Richard Hughes of Lakeland, FL, built an LW Trainer. Following plans from Tom Dixon of Marietta, GA, he plans to use a modern 3-channel radio and to power his Trainer with a 1978 O.S. .15. Dick's cute answer to construction needs was to adapt a Sig Kadet Jr. wing kit to the Trainer's configuration. We're seeing a steady growth in this VRCS movement, and ingenious modelers are always finding simple solutions to their problems.



For VRCS activity, Dick Hughes has a new LW Trainer, which has a vintage O.S. .15 engine and a modern 3-channel radio.



That sure looks like a stock LW wing on Dick Hughes's Trainer, but it's a reconfigured Sig Kadet Jr. wing!

PRO-LINE PARTICULARS

What made Pro-Line so fabulous for its time?—the company's high standards, which were always so visible in their products. Inside the attractive boxes, you found "mil-spec" components all precisely arranged on circuit boards that were encapsulated against vibration and humidity. Each section of the circuit was on its own board, firmly mounted and connected with plugs and sockets. Much like with modern televisions, changing a circuit was obviously easy, and the mechanics, antennas, gimbals, etc., were all first-class. Beyond the system's performance, it was attention to quality that obviously provided so much.

Eventually, Pro-Line offered four series of systems. Their flagship was the costly Competition series, which was aimed at contest fliers and their like. Competitively priced for sport fliers was the Challenger series, which was eventually superseded by the Cadet series. A 3-channel version for beginners was also offered but, for whatever reason, it lacked a distinguishing name.

In keeping with the Pro-Line philosophy, the less expensive systems were as good as the expensive ones in all respects; just the bells and whistles were missing.

Today, some modelers idolize the many features of current systems, while others damn them for the stupid problems they can cause. Some of these auxiliary functions can be advantageous, however, and Pro-Line was among the first to

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642	GERMAN AIRBORNE INVASION/HOLLAND	25 min.
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GOLDEN AGE

offer them. You could have an optional fast-charger that gave full battery capacity in just one hour. They also offered a convenient way to alternate between Mode II and Mode I, which was much more popular in Pro-Line's time than it is today. Then there were interchangeable frequency modules: you simply plugged in the desired frequency, just as you do today. Naturally, we wanted to be able to use the buddy-box training system, so that was included, too.

For competition fliers, there was adjustable dual-rate. This is prominent today, but we no longer have the so-called "slow-roll button." Those beautiful, stretched-out, slow, slow rolls were much easier to do when "just the right amount of aileron" could be commanded. Pro-Line was also very cooperative: if you had a particular auxiliary function you thought you needed, they were happy to add it to your system.



Not only was Pro-Line noted for high quality and excellent quality control, but it was ahead of its time in terms of circuitry layout—very modular.

Thinking about it, these are about the only auxiliary functions advantageous to flight. The others we have today, e.g., servo-reversing and throw adjustments are simply for convenience and mean little if you assemble the model correctly in the first place!

Another Pro-Line feature we don't see today was a fail-safe circuit in the receiver battery pack. Of course, no battery pack can be 100-percent fail-safe, but this diode circuit would allow a safe landing if one of the cells failed or a connecting wire broke (a step in the right direction?).



A distinctive Pro-Line ad from an early '70s issue of Model Airplane News. The company offered a radio for everyone.

Pro-Line offered a multitude of servo types, from the most compact and light to the most robust, powerful versions for large models. For those who wanted ultimate control, there was even one with linear outputs—the miniature, 1-ounce PL-21. Designed by Bob Dunham, this became the line's "workhorse" because it was powerful and rugged enough to fly almost anything.

In early propo days, after a less-than-auspicious flight, a pilot would often lament, "I have to clean my pots!" The brass servo-potentiometer (pot) wipers had a nasty habit of wearing the carbon pot elements and accumulating dirt, etc., which, in turn, made the controls twitchy. A Swiss modeler, Giesendanner, won one world champs and then made a major contribution to R/C by developing a carbon contact pads for the pesky pot wipers. This was actually a precisely formed piece of hard carbon that was about the size of a pinhead and locked into the brass wipers to give carbon-to-carbon contact. Eureka!—no more pot maintenance was required! Pro-Line quickly adapted the Giesendanner pot wiper to all their servos, and the final "weak link" was gone!

So much great flying has been done with Pro-Line radios that there must be hordes of owners with tales to tell. Do you have any to share? I'm sure others would enjoy hearing them! ■

ELECTRIC

Twins

by KEITH SHAW

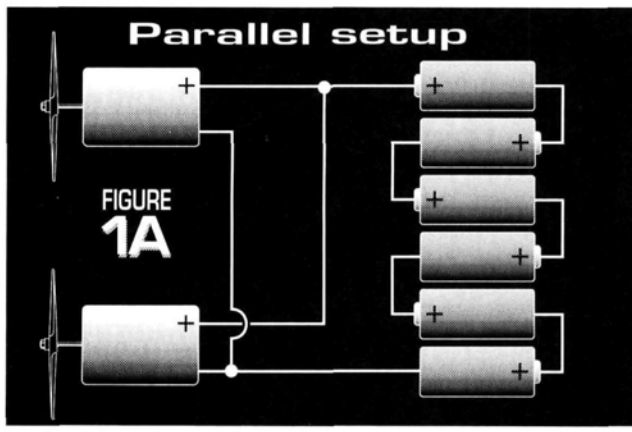


"Sunshine glints on the most graceful twin ever designed—the deHavilland Comet." Keith's 1/6-scale version was modeled after Amy and Jim Mollison's "Black Magic," which competed in the 1934 England-to-Australia MacRobertson Race.

TWINS! There probably isn't a modeler alive who hasn't dreamed of building and flying a twin. The classy lines, unique appearance and sound are but a few of the attractions. But the reality of cramming two engines, two mufflers, two fuel tanks and some creative throttle linkage into the nacelles is a bit challenging. Of course, the wing spar must be much stronger and more torsionally rigid to support all that extra weight and vibration. Then there's the fun of trying to tune two engines and getting the throttle responses to match, along with all those weird resonances. Finally, there's the worry of the one-engine-flameout-on-takeoff nightmare. With all these concerns, most modelers just think "maybe next year."

Fortunately, electric power provides an almost total solution to the twin dilemma. Since both motors are powered by a single battery pack, worries about asymmetric thrust or single-engine failures are non-existent. Even as the battery runs down, the motors stay in sync. Installation is almost trivial, as the only thing in the nacelle is a small vibration-free motor, while the batteries and speed controller are in the fuselage area.

Electric power can also enhance the realism of a twin. The multi-engine configuration inherently gives more efficient thrust per horsepower. Glow-powered twins, however, usually use larger than normal engines to compensate for the higher structural weight, and they allow a safety margin in the event of an engine failure. The higher wing loading and power loading give most glow-powered twins a very fast, frantic, non-scale flight appearance, not to mention spectacular crashes. The absolute reliability of electrics, along with their better weight distribution and more efficient thrust, allows a somewhat lower-powered system to give the equivalent performance of a single-motor aircraft. An electric twin usually comes out lighter than a glow-powered one with a more scale flying speed and a slower, gentler landing speed. My 1/6-scale, 88-inch, deHavilland Comet weighs 7 1/2 pounds, while the three glow-powered versions that I know about weigh 12, 14 and 15 pounds!



Design tips for light, reliable multi-engine flying

THE POWER SYSTEM

There are two ways of connecting two motors to a battery pack: in parallel or in series. For the sake of example, let's assume we're using 6-cell motors that nominally draw 20 amps (120 watts).

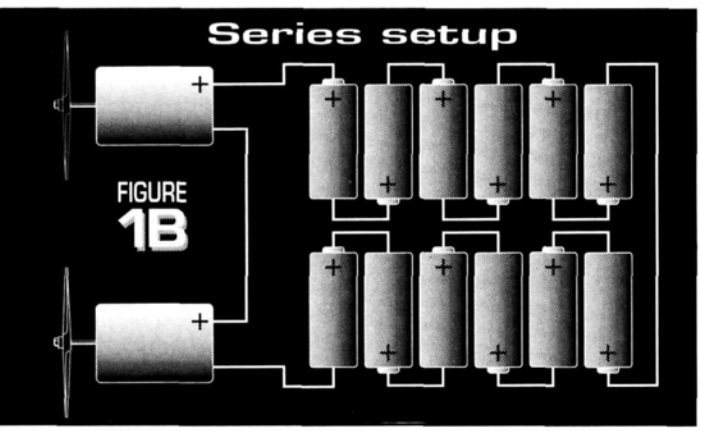
In a parallel setup, each motor receives the voltage of the 6-cell pack, but since each motor draws 20 amps, the total current drain is 40 amps (see Figure 1A). Even with the best Ni-Cds on the market—the Sanyo* "R" series—a 1200mAh pack would only give a 2-minute motor run. Larger capacity Ni-Cds could be used, but the hidden problem is that, at these high currents, the output voltage of the Ni-Cd pack is quite depressed owing to internal losses. Motor rpm will be lower than normal, and the battery will get very hot. About the only time a parallel power system works well is with small ferrite motors that run at 6 to 10 amps. This keeps the battery current within reason, and it may allow the joy of flying a twin with inexpensive speed controllers and chargers by staying under seven cells.

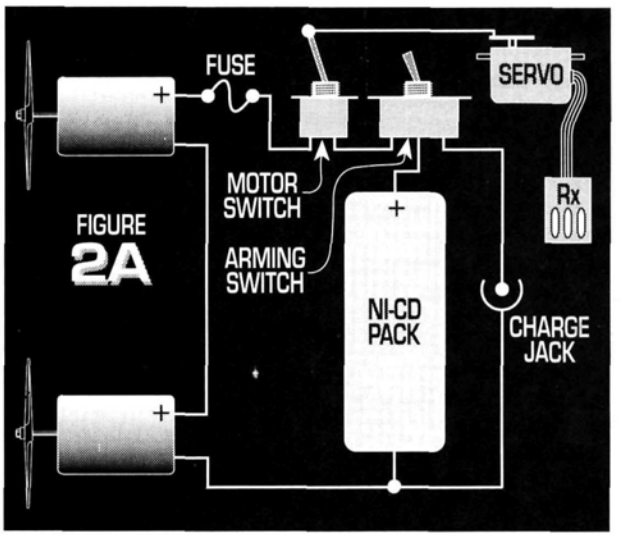
The other method is to connect the motors in series, with twice the number of cells in the battery pack (see Figure 1B). This would mean the two motors would be wired in series to a 12-cell battery. If the motors are reasonably well-matched (same make, size and vintage), they'll each "see" six cells, while the total current drain will stay at 20 amps. Now the Ni-Cds can efficiently deliver power, giving longer motor runs, higher rpm and a lot less heat.

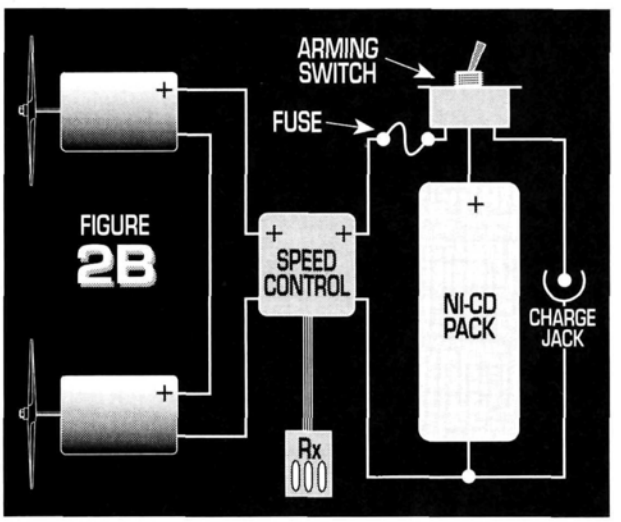
An electric twin usually comes out lighter than a glow-powered one with a more scale flying speed and a slower, gentler landing speed.

It's important to be able to control the motor power, and this can be done with a simple on/off switch or a speed controller. For small hand-launch twins (maybe up to 12 cells), a servo-operated switch, fuse and arming switch can be inserted into the series loop (see Figure 2A).

A good speed controller, however, would be desirable for aircraft that are designed to take off from the ground (see Figure 2B). The instantaneous power of electrics requires smooth power application to ensure good ground handling. Be sure to use an efficient, high-frequency speed controller that's capable of handling the number of cells and maximum current for your particular design. I've had excellent results with all the Jomar* units and the newer AstroFlight* 205 and 207. Make sure that the arming switch is wired as shown to isolate the speed controller from the battery pack during charging. Many "booster" chargers (the type that's capable of charging 8 to 32







cells) put out high voltage spikes that might damage the speed controller.

Since there are more plugs and wiring in a twin installation, use only the high-tech 12-gauge wire (the stuff with 600+ strands), and low-loss connectors such as those by Sermos*, or the new AstroFlight units. I try to hard-wire as many connections as possible, with plugs only at the battery pack and wing-disconnect point.

About the only limit to the series motor setup is that 28 to 32 cells are the most that the best currently available booster chargers can handle at one time. This maximum system could, however, deliver over 1hp—easily enough to get a 12- to 18-pound aircraft airborne, after which the power could be reduced to cruise level for a longer flight.

SIZE AND PERFORMANCE

The method that I use to estimate aircraft size, power loading and performance is identical to that outlined in "Electric Sport Scale," an article I wrote for *Model Builder* (July 1987).

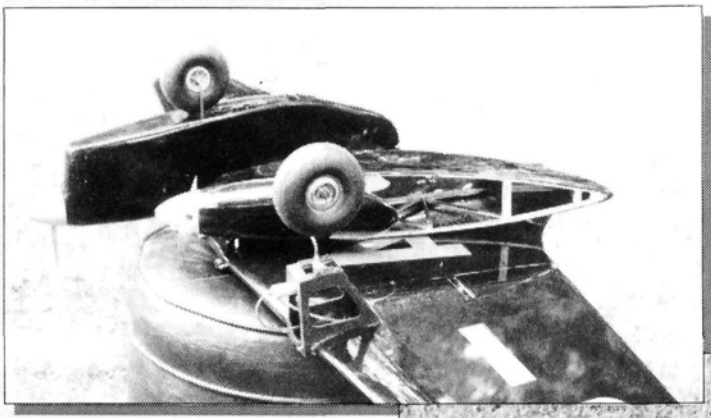
Be sure to pick a subject to match your flying skills. Many twins don't deserve their bad reputation, since it's usually related to poor handling with one dead engine. A classic example is the P-38, which flies quite well, but is a real nightmare on one engine. You should consider the size, configuration, landing-gear arrangement, weight and performance, and think less about the mythology of the prototype. Could you fly a single-engine plane of this type? If not, gain more flying experience before tackling that project. Many multi-engine aircraft of the 1925 to 1940 era would make excellent Sunday fliers. Of course, military twin fighters, bombers and transport aircraft will require much more flying skill, as would many of today's business aircraft. They're notori-

Twin examples and structural considerations

The structure of small hand-launched twins can be very similar to single-motor sport electrics. Simple D-tube wings with one shear-web-braced spar, and sheet-balsa tail and fuselage work very well. The nacelles can be made of sheet balsa and just glued to the wing sheeting. A little glass cloth or 1/32-inch-thick ply will protect the bottom of the nacelles or fuselage during landing. An example of this type is Jack Laird's stand-off-scale Westland Whirlwind. It spans 57 inches, has 450 square inches of wing area, weighs 70 ounces and is powered by two Leisure* direct-drive 05 motors on 12 Sanyo 900 SC cells turning Cox* 6x4 props. The power loading is 55 watts per pound with a flight-speed-to-stall-speed ratio of 3:1. With a simple servo-operated on/off switch, it gets excellent, aggressive 4+ minute flights. If it had a speed controller, I guess it would easily achieve 8- to 10-minute flights. The canopy and complex curved fuselage front are made with bead foam that's sanded to shape and covered with 3/4-ounce glass cloth. The finish is Coverite Micafilm* and Perfect Paints*.

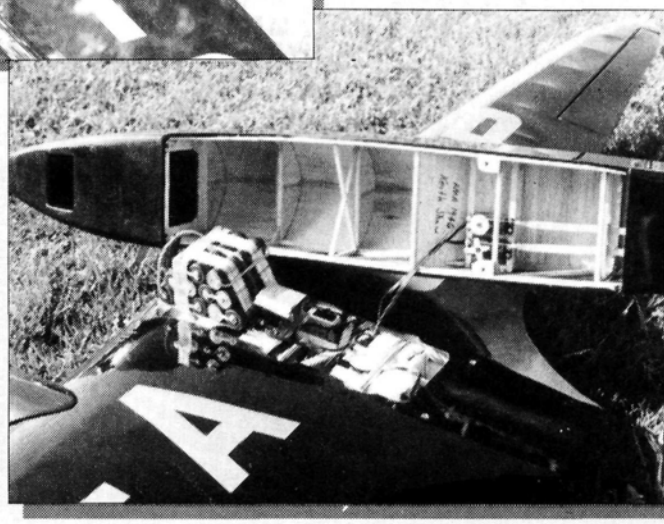
Jim McDermott's dream plane was the P-61 Black Widow, on which he was crew chief during WW II. He started out with a set of plans by Frank Baker (*Model Aviation*, February 1982), but he stretched the span by one rib on each side and increased the tip chord somewhat. He also changed the airfoil to a Clark Y, reduced most wood sizes and made the complex fuselage shapes out of blue foam that he covered with silkspan and attached with white glue.

The P-61 is a one-piece airplane with the radio and speed controller in the center pod and the Ni-Cd packs on top of the



Left: the D.H. 88's retract landing-gear towers support the Rhom-Airs, while the lightweight nacelles only contain the small Keller electric motors.

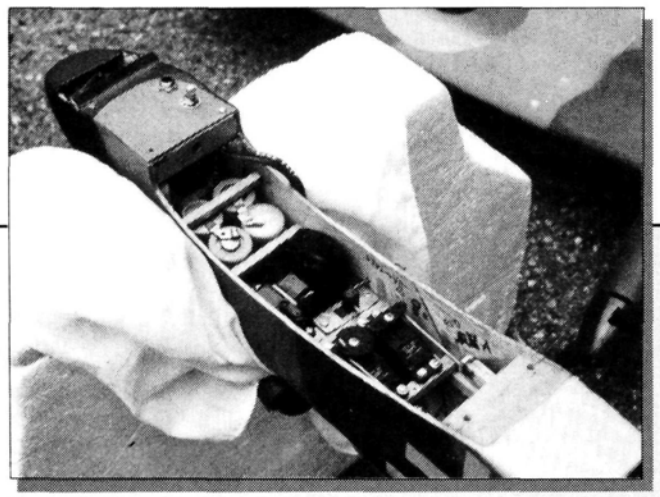
Below: the fuselage is just a shell that contains two servos, and it covers the Ni-Cd power pack; the speed controller; the aileron, flap and retract servos; the receiver and the battery.



ous for their huge fuselages and small wings.

Matching the size of the model to the appropriate powerplant is an iterative process:

1. Obtain a good three-view of your dream plane (hopefully showing cross sections), and guess the size of model you'd like to build. Remember, it has to fit in your workshop and/or car! Then calculate the wing area, length, fuselage cross section, nacelle, spinner, wheel and propeller size.
2. Now determine the desired handling characteristics. For an easy-flying, casual type, try to stay in the 14- to 18-ounces-per-square-foot range. For small hand-launched planes (<350 square inches), keep to lower wing loadings. On very large aircraft (>1,000 square inches), 20 to 22 ounces per square foot still gives gentle handling. More aggressive aircraft, such as fighters and bombers, fly very well with 20 to 25 ounces per square foot—even up to 30 ounces per square foot for the biggies— but better flying skills will be needed. Choose an airfoil to match the intended type of flying. I see little reason to put a "scale," nearly symmetrical wing on a sport-scale airplane unless you plan to do outside loops with it! Mildly cambered airfoils (2 to 3 percent) will have much lower induced drag at the desired scale-like speed. Less drag means lower required power and longer flights. My favorite airfoils are the Clark Y, the NACA 2412, 1412 and 23012.



The inside view of Jack Laird's Westland Whirlwind shows Ni-Cds in the nose, the motor switch, the servos and the receiver.

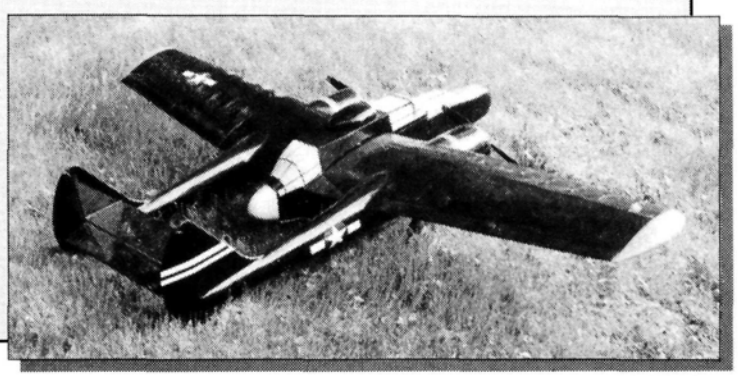
wing under a removable top shell. It has a 63-inch span, a wing area of 570 square inches and weighs 86 ounces. Its power system is two Astro 035 geared motors, 12 900mAh SCR cells, a Jomar SM-4 speed controller and 9x8 props. With a power loading of 40 watts per pound and a flight/stall-speed ratio of 2.2:1, the plane easily lifts off a grass runway in 50 feet, flies very well and is capable of some modest aerobatics. Continuous full-power strafing runs last over 5 minutes, while reduced power prowling can go on for more than 8 minutes.

My deHavilland Comet has been around since 1985 and probably has more than 300 flights on it—a clear indication of the reliability of an electric twin. This 1/6-scale plane has a wing area of 900 square inches, a wingspan of 88 inches and weighs 7.5 pounds. The power system consists of two Keller 25 motors (German 12-cell Cobalt) and 24 Sanyo 1200mAh SCRs that are controlled by a Jomar SC-4 turning Rev-Up 9x7 props at 9400rpm. With a power loading of 64 watts per pound and a flight/stall-speed ratio of over 4:1, it performs large majestic loops, graceful rolls and a host of other aerobatic maneuvers. The high-aspect-ratio wing and sleek fuselage and nacelles are very efficient, allowing low-power cruising flights of up to 15 minutes, or 6 minutes of full-power aerobatics.

The Comet needed some pretty involved engineering, however. Its high-aspect-ratio wing and slightly swept quarter chord required a triangulated spar system to enhance torsional rigidity, especially in the landing-gear area. The primary spar is located at 30 percent of the chord and is made of 1/8x1/2-inch spruce (top and bottom) with full-span shear webs. A similar secondary spar starts out at 70 percent of the root chord and sweeps forward to meet the main spar one rib bay beyond the nacelle.

The retractable landing gear is pivoted near the bottom of a very deep nacelle, but instead of making the nacelle structurally strong enough to support the whole airplane, a plywood and spruce "tower" that keys into the wing spar was designed to support the Rhom-Air* retract unit. The nacelle is then just a very light built-up shell that's held in place by a couple of 1/8-inch dowels in front and a 6-32 bolt near the rear wing spar. Necessary nacelle strength is minimal, as the only thing it supports is a small, vibration-free 8 1/2-ounce motor. With this configuration, the wing must contain the retract system, the aileron and the flap servos. Because of the large wing chord, the radio receiver, switch, battery and speed controller are also included in the wing.

The 24-cell power pack is mounted on hardwood blocks that are keyed into the wing spar. With this tidy package, the fuselage contains only the rudder and elevator servos, and it becomes a light, clip-on shell that's just strong enough to keep the tail in place. The fuselage and nacelles are old-timer truss boxes with some simple bulkheads and 1/16-inch-thick sheeting on top. The nacelles each weigh 3 ounces, while the 5-foot-long finished fuselage weighs 14 ounces, including two servos, instrument panels, cockpit detail and two pilots! Had traditional glow-construction techniques been followed, the airplane would probably have been 3 to 4 pounds heavier. Think creatively and look for ways of saving weight.



Jim McDermott's P-61 Black Widow, the "Moonlight Serenade," has a 63-inch wingspan, a wing area of 570 square inches, and it weighs 86 ounces. Twin Astro-geared 035 Cobalt motors are powered by 12, 900mAh Sanyo SCR cells. The speed controller is a Jomar SM-4. The plane flies great and looks particularly sinister on low-level flybys.

Total weight (ounces) = **[chosen wing loading** (ounces/square foot)**] x [wing area** (square feet)**]**

3. I really can't think of any highly aerobatic twins, so modest power loadings are acceptable. Bombers and transports should fly well with 40 to 50 watts per pound. Even fighters with the highest performance should, at most, require 60 to 65 watts per pound. This would allow loops, rolls, climbing rolls, spins, snaps and inverted flight. We're striving for realistic scale-like performance, not turn-around pattern capabilities.

Peak power (watts) = **[chosen power loading** (watts/pound)**] x weight** (pounds)

4. Next, an estimate of the static current draw is needed. This is, of course, related to the size of the Ni-Cd "fuel tank" and the desired full-power flight time. With a fixed-capacity Ni-Cd pack, higher current drain (more horsepower) means shorter flights. The commonly used Ni-Cds in electric flight are the 900mAh, 1200mAh and 1500mAh cells. I prefer the Sanyo "R" cells, as they can deliver the necessary power with little loss or voltage droop. The "E"-type cells run much hotter, are finicky to charge and deliver less usable power to the motors.

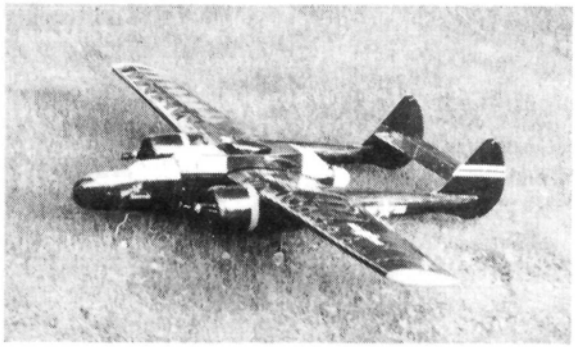
A good starting point is to choose a current that would give a 5- to 5 1/2-minute flight at full power. Since twins are usually quite efficient, this would correspond to a static current of 16 amps for 900mAh cells, 20 amps for 1200mAh, or 25 amps for 1500mAh cells. With some judicious use of the speed controller, flights of 8 to 10 minutes aren't uncommon. Even though my deHavilland Comet can do a very aerobatic 6-minute routine, its flights have several times exceeded 15 minutes just cruising up and down the runway at low throttle.

Good Ni-Cds deliver slightly more than 1 volt per cell to the motor at the indicated currents, so we can estimate the number of cells necessary to create the power calculated in Step 3.

Number of cells =

$$\frac{\textbf{peak power (watts)}}{\textbf{estimated static current (amps)}}$$

5. The size of the motor will be dictated by the number of cells. If a series layout is chosen, each motor will see half this number of cells. So if you've calculated that 250 to 300 watts would be necessary for your project and you want to use 1200mAh SCR cells (allowing a 20A static drain), this would imply the use of 12 to 15 cells, or six to seven cells per motor. This would be two 05 motors. I highly recommend the use of Cobalt magnet motors (such as AstroFlight's) not only for their high quality, performance and ruggedness, but also because they're much more stable under high temperatures and aging conditions.



Jim McDermott's P-61 Black Widow.

Many motors are now rated by number of cells and maximum wattage (as they should be), rather than the old glow-equivalent method. To guide you, the Cobalt "035" motors use five to six cells and a maximum of 120 watts, the Cobalt "05" motors use six to eight cells at a maximum wattage of 180 watts, the "15" uses 10 to 14 cells at 250 watts, the "25" needs 12 to 16 cells at 350 watts, and the "40" can use 16 to 20 cells at 450 watts. Remember, these maximum wattages are for the long motor runs in a scale plane, not the short sprints used by the high-powered gliders.

With the exception of some small hand-launched twins, most motors will have to be geared to turn the larger props necessary for efficient thrust. Some of the expensive European motors are available in a wide array of windings that allow a prop of almost any size to be matched directly to the motor, thereby eliminating the need for a gearbox. Once the motor size has been chosen, look up the weight (with the gearbox if needed) in the manufacturer's literature. The Ni-Cd pack weight can be estimated, as 900mAh cells weigh about 1.4 ounces, 1200mAh about 1.8 ounces, and 1500mAh about 2.2 ounces. If this results in a power system that you don't own and don't want to purchase, or can't charge, go back to Step 1 and try again.

6. By subtracting the weight of the two motors and necessary number of cells, along with the weight of the appropriate radio equipment, from the total weight in Step 2, we get the finished airframe weight. Choose light servos with sufficient torque to do the job. Don't expect .6-ounce servos to control a 12-pound airplane, and don't cram 1.8-ounce servos into a little hand-launched plane.

A good receiver is essential for electrics, as some of the cheaper units work



Keith's D.H. 88 has an 88-inch wingspan, a wing area of 900 square inches, and it weighs only 7.5 pounds. It's powered by twin Keller 25 motors, and it carries 24 Sanyo 1200mAh SCR batteries, a Jomar SC-4 speed controller, and Rhom-Air retracts.



Jack Laird's Westland Whirlwind weighs 70 ounces, and it has a wingspan of 57 inches and a wing area of 450 square inches. Twin Leisure 05 direct-drive motors are powered by 12, 900mAh Sanyo SC cells. The plane uses an on/off motor control, and it's a very aggressive, aerobatic performer.

poorly, if at all, owing to poor rejection of electrical noise. ALWAYS do a thorough range check (with the motors running) before flying any electric. Small models can use a 100mAh receiver battery; mid-size ones use a 270mAh; and even the largest models work OK with a 450mAh pack. Once you become accustomed to field-charging Ni-Cds, the radio battery can also be recharged if you feel it's running low. I'd *never* use battery-eliminator circuitry (BEC) on even the smallest planes; it's not worth the risk. It only "saves" an ounce and can cause major interference problems, since it pipelines motor noise directly into the receiver.

7. Now for the big question: can you build this project to the estimated weight? Most modelers want a plane that flies well, so an exact replica isn't required. Partially sheeted wings and tail surfaces and open-structure fuselages can save a lot of weight. Flat areas on the fuselage and tail can be free-hanging covering rather than sheet balsa. Block balsa may be used to reproduce complex shapes but should be hollowed to a wall thickness of, at most, 3/16 inch. White or blue foam may be shaped as desired and covered with silkspan, kraft paper, or light glass cloth. Because there's little vibration, plywood should be used only in high-stress areas, such as landing-gear bracing, dihedral joiners, or battery pack supports. It isn't worth cutting holes in ribs, as this saves very little weight and weakens the structure too much. The newer lightweight wheels can save many ounces.

Film covering can save a lot of weight, but be careful of some iron-on fabrics, because they're very heavy, especially if painted. If you insist on a painted finish, clear MonoKote* may be painted with a lightly airbrushed coat of Floquil* or other lacquer-based paints. Always clean the surface with acetone first to remove any fingerprints. My 62-inch Spitfire gained 3 ounces with the MonoKote and an additional 3/4 ounce when I painted all the camouflage, roundels and squadron markings. Panel lines, rivets, louvers, latches and a host of other details can be done with permanent markers, MonoKote and creative airbrush shading. Optical illusions can save a lot of weight!

8. The final step is matching the correct props to your airplane. This is where many electric and glow models fail, or seem just mediocre. The right prop can make a tremendous difference to performance. Each prop requires a specific horsepower (watts) to turn it at a given rpm. If you wish, a good test rig can be set up with the motor and battery pack, a tach to monitor rpm, a voltmeter to measure motor voltage, and a good ammeter to measure motor current. There are several very inexpensive digital voltmeters available. (Radio Shack has one for about $18.) If you're really serious about electrics, an instrument-quality ammeter is a must. I use a Simpson 0 to 50A panel meter, which is available from electronics suppliers such as Pioneer or Newark for about $50. The $25 ammeter that's available from some hobby suppliers is much less accurate, but usable for relative performance estimates. (The test-stand layout appears in Figure 3.)

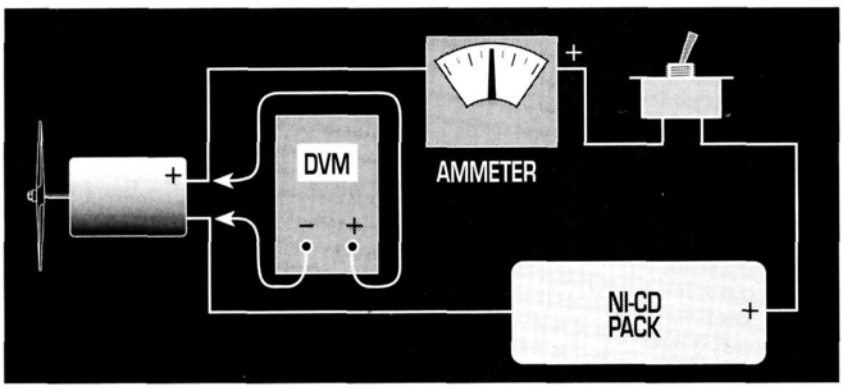


FIGURE 3

At a given voltage, there's a unique relationship between current and rpm. Props of various diameters, pitches and brands may draw the same current, so how do we decide which one would best suit our project? Remember, when we estimated performance in Steps 3 to 5, we only predicted the total wattage, current and number of cells. Once the actual power system has been decided, there will be a specific rpm for the current chosen in Step 4. One approach would be to randomly try all props that meet the desired parameters and see which ones work best. The problem is that some of these props might not be able to get the plane airborne safely. Here's a technique I use to choose a reasonable range of test props.

The stall speed for our models is mostly a function of wing loading, airfoil choice and surface finish. For wing loadings in the 14 to 25 ounces-per-square-foot range and the type of airfoils discussed in Step 2, a reasonably accurate estimate of stall speed is:

$$\text{Stall speed (mph)} = 3.7 \times \sqrt{\text{wing loading (ounces/square foot)}}$$

Prop speed is that which a highly streamlined airplane would achieve in level flight, and it's caused by a prop of a certain pitch turning at a known rpm. Sweep-

ing several canceling effects under the rug, it can be estimated as:

Prop speed (mph) = **Pitch** (inch) **x** **rpm** (in thousands)

Actual flight speed of most streamlined twins will be at the prop speed or a little faster. This is due to the motor unloading in the air, which allows a higher rpm. A higher-drag airplane, such as one with large radial engine cowls or a large cross-section fuselage, might only achieve 85- to 90-percent prop speed. As an example, a 10x8 prop turning 9,000rpm on a clean monoplane would have a level flight speed of about 70mph.

A level flight speed of twice stall speed is required to just do a nice, round loop. This would be more than adequate for any bomber or transport. At three to four times stall speed, good maneuvering and fighter-type performance is easily achieved.

Finally, the type of aircraft has an effect on the optimum diameter-to-pitch ratio. Aerodynamically clean twins will work best with a ratio somewhere between 1.3:1 and 1.7:1, while "draggier" aircraft such as bombers and transports would probably benefit from a 2:1 ratio.

To help you put all this prop stuff together, an example of prop choice is in order. Let's assume we've chosen a slower transport aircraft that has a wing area of 700 square inches and an estimated weight of 5 1/2 pounds (18 ounces per square foot wing loading). This plane would have a stall speed of about 16mph, a desired flight speed of 32mph and a required prop speed of about 36mph. For a power loading of 50 watts per pound, 275 watts would be needed; and at a chosen current drain of 20 amps, 14 cells driving two, Cobalt, geared 05s would be adequate. Mounting a geared, Cobalt 05 on our test stand with seven 1200mAh SCR cells, we'd find that a prop would turn at about 6,000rpm at 20 amps. To get a prop speed of 36mph at 6,000rpm we'd need 6 inches of pitch. Mounting several 6-inch-pitch props, we'd find that diameters of about 12 inches would pull 20 amps. Happily, this would be a 2:1 ratio, so a 12x6 prop would be a good starting point for this hypothetical design.



Keith Shaw shows off his "King Crimson" flying wing at last year's KRC Electric Fly. The wing has a 10.5-foot span, weighs 10.5 pounds and is powered by four Leisure ferrite 05 motors. He advises a different type of design analysis is required for building one of these!

Most people can't believe how large an airplane can be flown well on such seemingly small motors.

A hidden advantage of electrics is that it's easy to add a little extra horsepower for the test flight. This can ensure an easy takeoff and climb to safe altitude, where handling, stall tests, CG tests and a couple of practice landings at altitude can be done. In the example given, this might mean test-flying with 12x7 or 12x8 props. Once the airplane is trimmed out, you can pursue the perfect prop by trying values near the predicted ones. You might find out that it likes a Rev-Up* 11x8 or a Top Flite* 11x7 better than the predicted 12x6.

Once you're comfortable flying your twin, three- or four-blade props can be tried to enhance scale realism (assuming the prototype had them) at some loss in performance. As a rule of thumb, use a prop of the same pitch, but 10 to 15 percent smaller in diameter.

I've tried counter-rotating props on several of my twins with very little change in performance or handling. Extensive testing is quite limited, since there are only a few really well-matched right- and left-handed props. Flying 10 degrees crosswind induces much worse errors than the slight improvement in tracking with counter-rotating props. It's better to use props that work best on the plane and learn "rudder finesse" to compensate for any tracking errors.

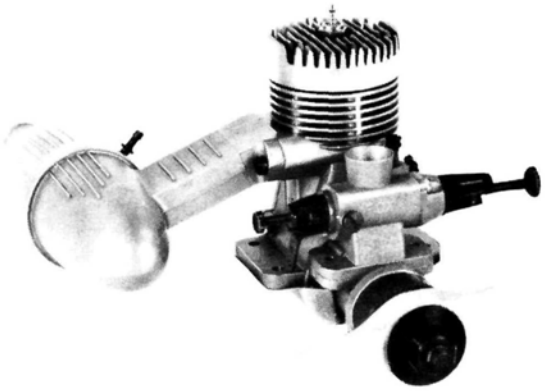
CLOSING THOUGHTS

By now, I hope you can see all the benefits of electrifying multi-engine aircraft. Having built four twins, a tri-motor and a four-motor plane, I can't imagine going back to doing a glow-powered one. Most people can't believe how large an airplane can be flown well on such seemingly small motors. This design technique will help you get used to this phenomenon.

In fact, once some experience is gained at matching correct power systems to an airplane of a particular size, the whole design procedure can be turned inside out. Starting with a given set of motors and an appropriate number of Ni-Cds, and choosing a desired current

(Continued on page 117)

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AIRWAVES

(Continued from page 66)

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Evgeni, we were delighted to have the opportunity to meet Soviet modelers and see Soviet modeling products at the '91 WRAM show and to share this experience with our readers. We look forward to offering more coverage of Soviet modeling, and we'll let our readers know if your

(Continued on page 111)

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AIRWAVES

(Continued from page 97)

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HOOKED ON MODELING

R/C model building has recently entered my life, and I'm happy to report that I'm firmly hooked. I've been a static model builder for almost 20 years, and the transition into flying models is very exciting. I've built a trainer and, recently, I started a Top Flite P-39 stand-off-scale kit to help develop my building skills.

Legacies from my static model days are my love of WW II-era warplanes and my obsession with detail. Although I'm building the Top Flite kit with as much scale appearance as possible, I consider this to be a learn-ing experience and a logical step towards mastering the art. I plan on attempting a scale aircraft for my next project.

I've discovered that the Airacobra isn't nearly as well-known as aircraft developed later in the war. Consequently, a relatively small number of stand-off-scale kits are available, and I've yet to find a scale kit or scale plans for the P-39.

(Continued on page 112)

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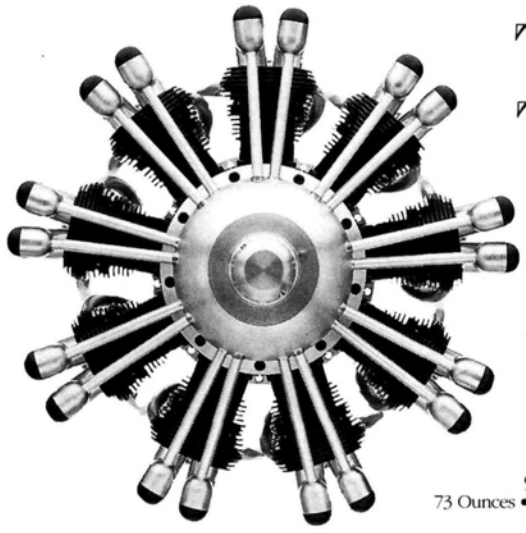
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AIRWAVES

(Continued from page 111)

The July issue of *Model Airplane News* included an article on the "Spring 1991 Warbird Mini Reno Races" in which you included several photos of P-39 aircraft that were present at the meet. These entries raised my hope that a source was yet available for a scale kit or plans. Any help or suggestions that you can provide would be most appreciated.

DENNIS R. ROWAN
Glendale, CA

Dennis, Joe Zimmerman of Consolidated Models offers a scale kit of the P-39 that may well be the model you're seeking. You can reach Joe at 2925 Golf Rd., Turlock, CA 95380; (209) 668-4505. To achieve as much realism as possible, or if you decide to scratch-build, you will, of course, want to obtain scale documentation. Bob Banka of Scale Model Research supplies three-views and photos of the P-39. He can be reached at 2334 Ticonderoga Way, Costa Mesa, CA 92626; (714) 979-8058. Our new book, "Flying

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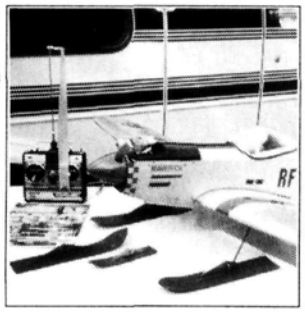
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AIRWAVES

(Continued from page 112)

Model Warplanes," by John C. Fredriksen, lists over 50 kits and plans for this plane (including R/C, free flight and control line). We hope this helps and that you'll send us a picture of your completed project! TA

(Continued on page 125)

CHRISTEN EAGLE

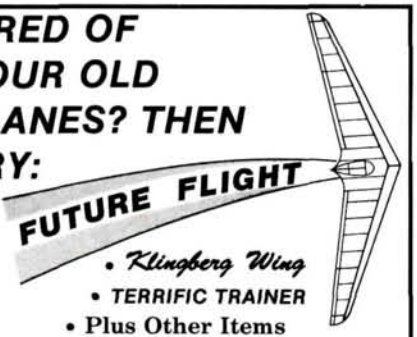
(Continued from page 72)

your landings fall into the second category, bend a piece of 1/8-inch music wire to follow the gear contour, and attach it with J-bolts. This will dampen the springiness of the gear and help to smooth out the arrivals.

After 30 flights, the Eagle is going into its second season, and it's still 100-percent original (including the Master Airscrew* prop). Others have flown it and they marvel at its vertical performance and its overall mild manners. The Eagle is a potent little airplane, so it's not for beginners. For proficient fliers, however,

(Continued on page 114)

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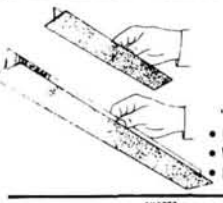
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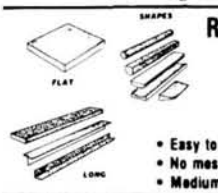


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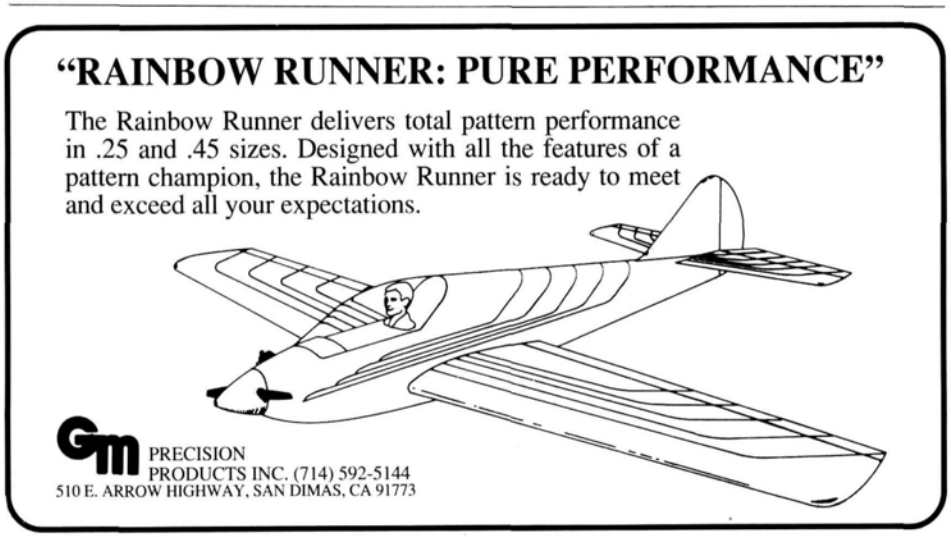
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CHRISTEN EAGLE

(Continued from page 113)

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Enya Model Engines/Altech, *P.O. Box 286, Fords, NJ, 08863.*

Williams Brothers Inc., *181 Pawnee St., San Marcos, CA 92069.*

Master Airscrew; *distributed by Windsor Propeller Co., 384 Tesconi Ct., Santa Rosa, CA 95401.* ■

ENGINE REVIEW

(Continued from page 78)

FUTURE, BACK-TO-BACK TESTS

Earlier, I mentioned long-stroke versions of the Speed 61F. Well, it might interest you to know that I intend to run back-to-back tests of a typical short-stroke pattern

(Continued on page 116)

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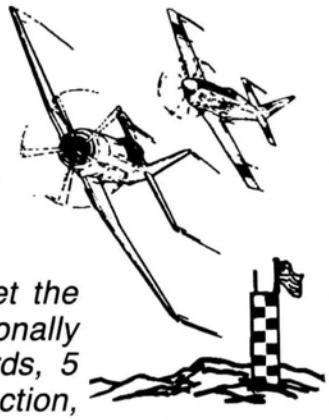
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ENGINE REVIEW

(Continued from page 114)

engine and its long-stroke counterpart. I hope to arrive at meaningful numbers to supplement (or even replace!) the general (usually subjective!) view of the differences between these engines. I'm also working on a "diesel-versus-glow" test. As soon as I have enough information, I'll pass it on to you, so watch this space!

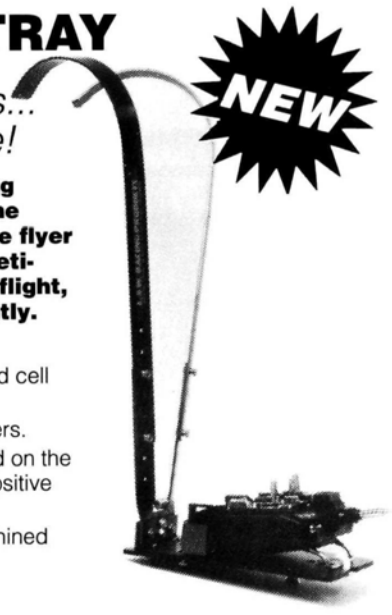
CONCLUSION

The Webra Speed Series 2-strokes have been with us for a while, and their qualities have set the standards against which other engine developments are often measured. This reputation has earned the Speed 61 versions considerable favor among sport fliers and competitors worldwide. The results of my tests show that they're a force to be reckoned with in an increasingly competitive world. ■



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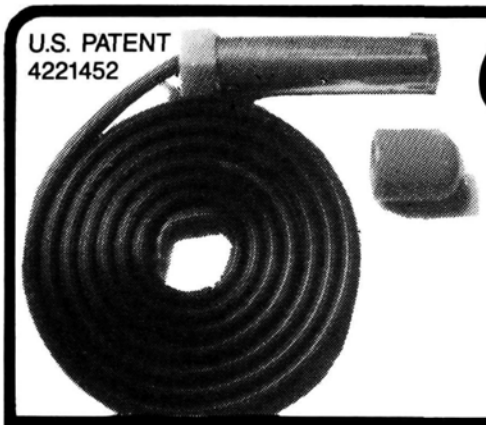
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ELECTRIC TWINS

(Continued from page 96)

drain, the peak wattage available can be calculated. After selecting a power loading and wing loading, the required area and size of the aircraft can be estimated. A check is necessary to be sure that the airframe can be constructed to meet the weight estimate. The prop selection technique is still the same.

Enough reading! Get out your abacus or pocket calculator and start designing your dream project. I'm sorry to say that I don't have any plans available for my airplanes, but I hope this article will inspire you to design your own. I'd be interested to hear about your results. My address is: 2756 Elmwood, Ann Arbor, MI 48104.

Here are the addresses of the companies mentioned in this article:

***Sanyo Electric,** Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.*

***Jomar Products,** 2028 Knightsbridge Dr., Cincinnati, OH 45244.*

***AstroFlight,** 13311 Beach Ave., Marina Del Rey, CA 90292.*

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***Leisure Electronics,** 22971 B Triton Way, Laguna Hills, CA 92653.* ■

BYRON EXPO '91

(Continued from page 57)

Iwo Jima. When the simulated bomb blast hit, you could just feel the heat flash on the forward flight line.

Sadly, a tragedy marred the last Striking Back show on Sunday, the last day of the Expo. Accounts indicate that Pilot

(Continued on page 118)

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BYRON EXPO '91

(Continued from page 117)

Mack Stevens Orr, of Friendswood, TX, stalled out when he was about to make a downwind turn in his full-scale Zero replica after pulling up somewhat steeply from a low-level pass. Apparently, as the airplane rolled toward a knife-edge position, it tip-stalled and fell to the ground, killing the pilot. An FAA investigation, although not published at the time of this writing, has apparently found the crash was due to pilot error, and that it occurred in the "waiver area" behind the "deadline" as established by the FAA for the air-show exhibition.

CHANGES FOR NEXT YEAR

Air show Director Joe Schumacher noted to me after the Expo that ducted fans won't be flown by participants at next year's Expo. They will, however, be flown by manufacturers in scheduled exhibition flights. At least two jets were lost in high-speed impacts this year, although without harm or property damage. Prop planes were also lost, as they usually are at any fly-in involving hundreds of pilots. The tremendous speed of ducted fans and

(Continued on page 119)

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Roy Vaillancourt
18 Oakdale Avenue
Farmingville, NY 11738
(516) 732-4715 after 6:30 Eastern time.

BYRON EXPO '91

(Continued from page 118)

the nearby presence of many thousands of spectators has apparently influenced show management to hedge on the side of caution.

In light of the large number of pilot applicants this year, consideration is also being given to holding an all-scale show. Joe said this year, "The number of applicants ballooned by about 50 people in the last weeks of July, to about 340 in initial registration. Because of the need to accommodate all, and for aircraft storage, we will limit the number of pilots to 300 next year." If you want to fly at the Expo '92, get your application in early.

(Continued on page 124)



New

Midwest's Wide Balsa Saves You Time . . .

No more truing, gluing and sanding, when you use Midwest's NEW Wide Balsa Sheets. More than just glued-up boards, these wide sheets are produced by an innovative new process. The consistent color, grain, and density of these wide sheets open a broad range of applications for hobbies, arts, crafts and structural design.

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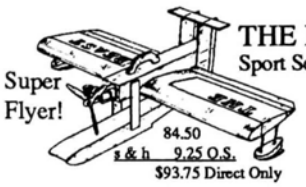
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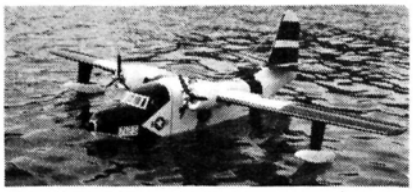
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104" SPAN FOR .60 ENGINES $649.95



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CANADAIR CL-215 81" SPAN $259.95

All models use .40 2C engines and feature a fiberglass fuselage with pre-joined halves. The kits include vacu-formed cowls and nacelles. The wings and empennage are made of small-bead, low-density foam and are pre-slotted for the spars. The kits feature pre-sawn spars, and all wood is included to build the planes. Retractable landing-gear kits are available for the Canadair and the Albatross. The 120-minute video covers building and flying. The kit comes with a 35-page construction manual with step-by-step instructions and detail drawings. ***Retractable landing-gear kit $179.95; Video $24.95.***
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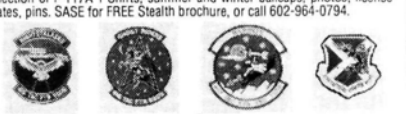


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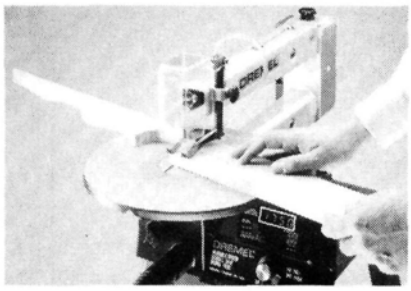


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PRODUCT NEWS

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by Model Airplane News, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in Model Airplane News.

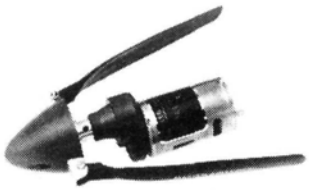


DREMEL
1695 Variable-Speed Scroll Saw

Dremel's sturdy new 16-inch, variable-speed scroll saw has a cast-iron base and professional features, e.g., an LED speed read out that displays blade strokes per minute (spm) in increments of 10 (from 200spm to 2,000spm). With its quick blade removal and smooth cast-aluminum table this saw makes inside cuts easy.

Price: $250

For more information, contact Dremel, 4915 21st St., Racine, WI 53406; (414) 554-1390.

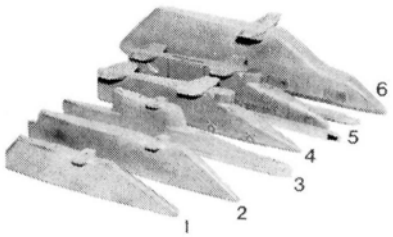


MASTER AIRSCREW
Electric Flight Pack

This flight pack includes: a 7.2V, 8019-can, ferrite, .05 motor with a built-in capacitor; a light, compact 3:1 gearbox with a rugged 3/16-inch steel shaft; an output gear that has been molded to the shaft to prevent slippage; and a 12x8 folding prop with under-cambered, glass-filled nylon blades that are hinged to a light aluminum hub.

Price: $39.95

For more information, contact Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385.



EAGLE MINIATURES
Scale Pylons

Eagle Miniatures has new weapon-accessories kits that come with scored vacu-formed pylons made of lightweight polystyrene. The following pylons are available: inboard, middle-wing and outboard F-16 pylons in 1/8 and 1/9 scale; 1/10-scale F-4 inboard pylons with straight noses or curved noses (these include launch rails and chaff ejectors); and F-18 pylons in 1/7 and 1/8 scale. All pylons are sold in pairs.

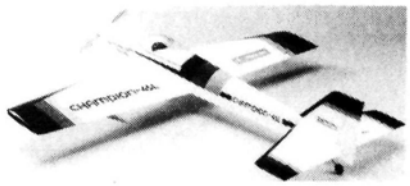
For more information, contact Eagle Miniatures Inc., P.O. Box 468, Streamwood, IL 60107; (708) 289-8194.



COVERITE
21st Century Spray Paint

Coverite's new goof-proof 21st Century spray paint dries dust-free in just 15 minutes and, after 12 hours, it's fuelproof; even fuel with up to 15 percent nitro won't damage it! It comes with a patented spray-gun nozzle that prevents runs. The paint comes in: white, light red, dark red, light blue, dark blue, lemon yellow, "cub" yellow, orange, black, metallic red, metallic blue, aluminum and white primer.

For more information, contact Coverite, 420 Babylon Rd., Horsham, PA 19044; (215) 672-6720.

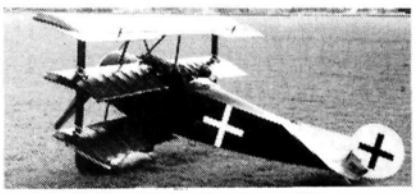


CHAMPION
45L ARF

With the Champion 45L, you can execute perfect FAI- or AMA-style aerobatic maneuvers: flat spins, knife-edge loops, rolling circles, sharp-cornered square loops, snap rolls, Lomcevaks and much more! This 55.6-inch-span plane is 90 percent ready to fly right out of the box, and it features a special symmetrical airfoil that gives it outstanding flight performance, even inverted. The Champion weighs 5.72 pounds and can use a .40 to a .45 2-stroke and a 4-channel radio. It comes with a complete hardware and accessory package.

Price: $249.95 (discounted: $169.99).

For more information, contact Global Hobby Distributors, 10725 Ellis Ave., Ste. E, Fountain Valley, CA 92728; (714) 963-0133.



GLENN TORRANCE
Fokker DRI Triplane

This 1/4-scale model has the accurate outlines and scale features of WW I's legendary Fokker DRI Triplane. Its top wingspan is 71 inches and, coupled with an ST2500 (or a comparable engine), it weighs from 14 to 16 pounds.

The kit contains two sets of plans (full-size and reference-size), die-cut ply and balsa parts, machine-cut hardwood parts, brass and aluminum fittings, step-by-step instructions and five-view drawings.

Price: $398 (plus $10 S&H)

For more information, contact Glenn Torrance Models, 2981 Vail Valley Ct., Snellville, GA 30278; (404) 985-4543.



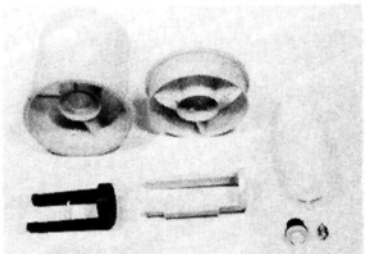
TEJERA
Auto-Trickle Adapter

Simply plug the Auto-Trickle Adapter into the wall, and plug your overnight chargers into it (as many as three). It provides the maximum protection against overcharging your Ni-Cd batteries because, after 14 to 16 hours, it will turn your overnight chargers into safe pulse-trickle chargers. Designed to handle a maximum of 120 watts, this adapter can supply power for up to 30 transmitter and receiver chargers, Ni-Cd starters, etc.

Part no. ATA-CX1

Price: $39.95

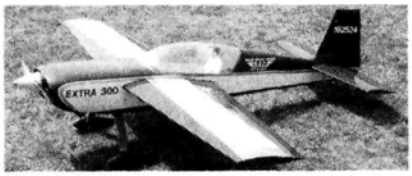
For more information, contact Tejera Microsystems Engineering Inc., P.O. Box 340608, Tampa, FL 33694; (800) 729-9210.



KRESS JETS
RK-20 Ducted Fan and Tire

Kress Jets' original RK-20 Ducted Fan is now available with the Micro-Mold rotor. The fan parts include a rotor, a spinner, forward and aft shell sections, a fuel tank/stopper and a beam-type motor mount. The basic motor mount (black, glass-filled nylon part shown) is for .20- to .28-class engines; the cast-aluminum motor mount (also shown) is for sport-class .40 to.45 engines. A fan drawing and an instruction book with pictures are also included.

For more information, contact Kress Jets Inc., 4308 Ulster Landing Rd., Saugerties, NY 12477; (914) 336-8149.

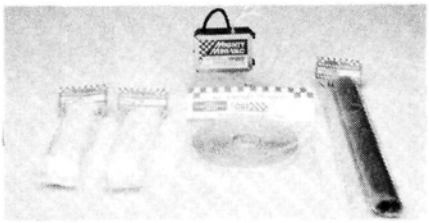


BANNER AIRCRAFT
Extra 300

Banner Aircraft's Extra 300, 1/5-scale R/C Sport Kit includes: a hand-laid epoxy/glass fuselage, cowl, cockpit and wheel pants; a clear canopy; bent, rolled 6061 T-6 aluminum landing gear; and custom-cut foam-cores for the one-piece wing, the ailerons, the stabilizer and the elevator. The kit also includes a fully illustrated instruction manual, and all of its wooden parts have been machine-cut from birch aircraft plywood. The Extra 300 has a 66-inch wingspan and weighs from 8 1/2 to 9 1/2 pounds. (Recommended engines: .90 to 1.08, 2-strokes or 1.20, 4-strokes.)

Price: $240

For more information, contact Banner Aircraft Designs, 5717 Sullivan Trail, Nazareth, PA 18064; (215) 759-3179.



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Build stronger models more quickly and easily with the Mighty Mini-Vac System. This continuous-operation electric pump has a set vacuum pressure that's safe for all foams. The system comes with a nylon bagging tube, a breather strip, bag sealant, tubing, fittings and instructions. With the rigid Mylar sheet (optional), making fiberglass-skinned wings with smooth finishes is a snap.

Price: $74.95

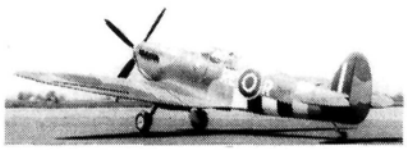
For more information, contact Composite Structures Technology, Dept. C81, P.O. Box 4615, Lancaster, CA 93539; (800) 338-1278.



FUTURE FLIGHT
Klingberg Wing 100

The high-performance Klingberg Wing 100 glider features a balsa-sheeted, foam-core wing; custom-designed airfoils that provide a wide speed range; removable out-wing panels; strip elevons and flaps; in-flight adjustable CG; and the Autoyaw control system. The kit comes with hardware and extra-wide Unimax balsa sheeting. This 100-inch-span glider has an area of 1,100 square inches, and it weighs less than 4 pounds.

For more information, contact Future Flight, 1256 Prescott Ave., Sunnyvale, CA 94089; (408) 735-8260.



RALPH ROPP MODELS
Spitfire Mk IX

Ralph Ropp's new built-up 1/4-scale Spitfire has a 110-inch wingspan, a 94-inch-long fuselage and, if the recommended Sachs-Dolmar 5.8ci engine is used, an estimated weight of 35 to 40 pounds. Plans, accessories and fiberglass parts are available.

For more information, contact Ralph Ropp, P.O. Box 608, Rocklin, CA 95677; (916) 782-6616.



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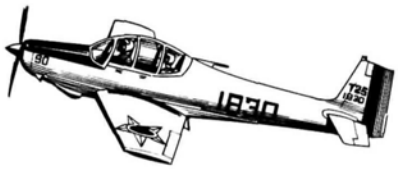
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BYRON EXPO '91

(Continued from page 119)

A few notable R/C aeromodeling events serve the greater good of the hobby by providing a very positive image of R/C to the world. Byron's Expo is certainly among the top-ranking events in this category. Byron Godbersen, the principal behind the Aviation Expo, and all those responsible for the Aviation Expo together, including Bruce Godbersen, Marc Jensen, Joe Schumacher and a host of unnamed others deserve thanks for a job well done that can only promote the growth of the hobby. Don't miss next year's Expo if you want to have a great time. ■

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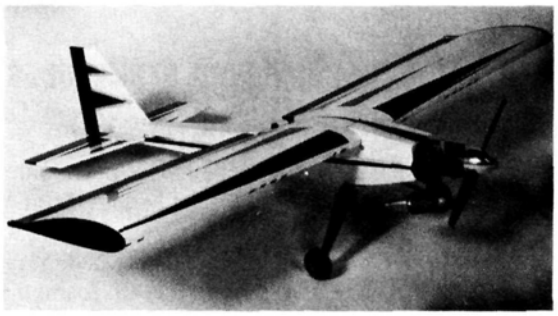
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AIRWAVES

(Continued from page 113)

DRAGONFLY DESIGN

I have a problem that I hope you could help me with. I've been interested in building a model of a Cessna A-37 Dragonfly, but I've been having trouble finding plans or scale drawings of it. If you know where I can find plans for it, would you please let me know?

ROBERT KNIGHT
Sterling Hts., MI

Robert, the Cessna A-37 Dragonfly would be a great project for R/C. I don't remember seeing any models of this bird even though it's one of my favorites. We don't have a source for plans or a kit, but maybe one of our readers will come to your aid. The only reference material we found is the "In Action Series" from Squadron/Signal Publications. Their book on the A-37/T-37 has many black-and-white photos, color illustrations and scale three-view drawings. You can write them at 1115 Crowley Dr., Carrollton, TX 75011-5010. GY

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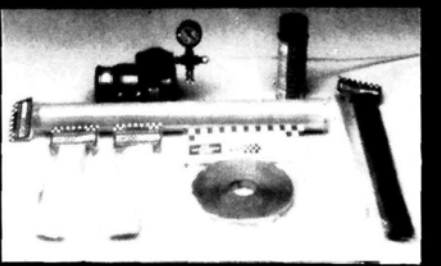
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Wing Span: 98 1/2 in. Length: 45 in.
Wing Area: 790 sq. in. Airfoil: Modified 205

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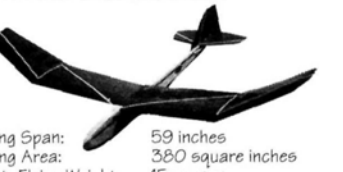
Wing Span: 50 1/2 in. Flying Weight: 11 1/2 ounces
Wing Area: 275 sq. in. Airfoil: Modified 205
Length: 31 1/4 in.



FLIPPER

Wing Span: 50 1/4 in. Est. Flying Wt.: 11 1/2 ounces
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Wing Span: 59 inches
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Est. Flying Weight: 15 ounces
Airfoil: Modified 205

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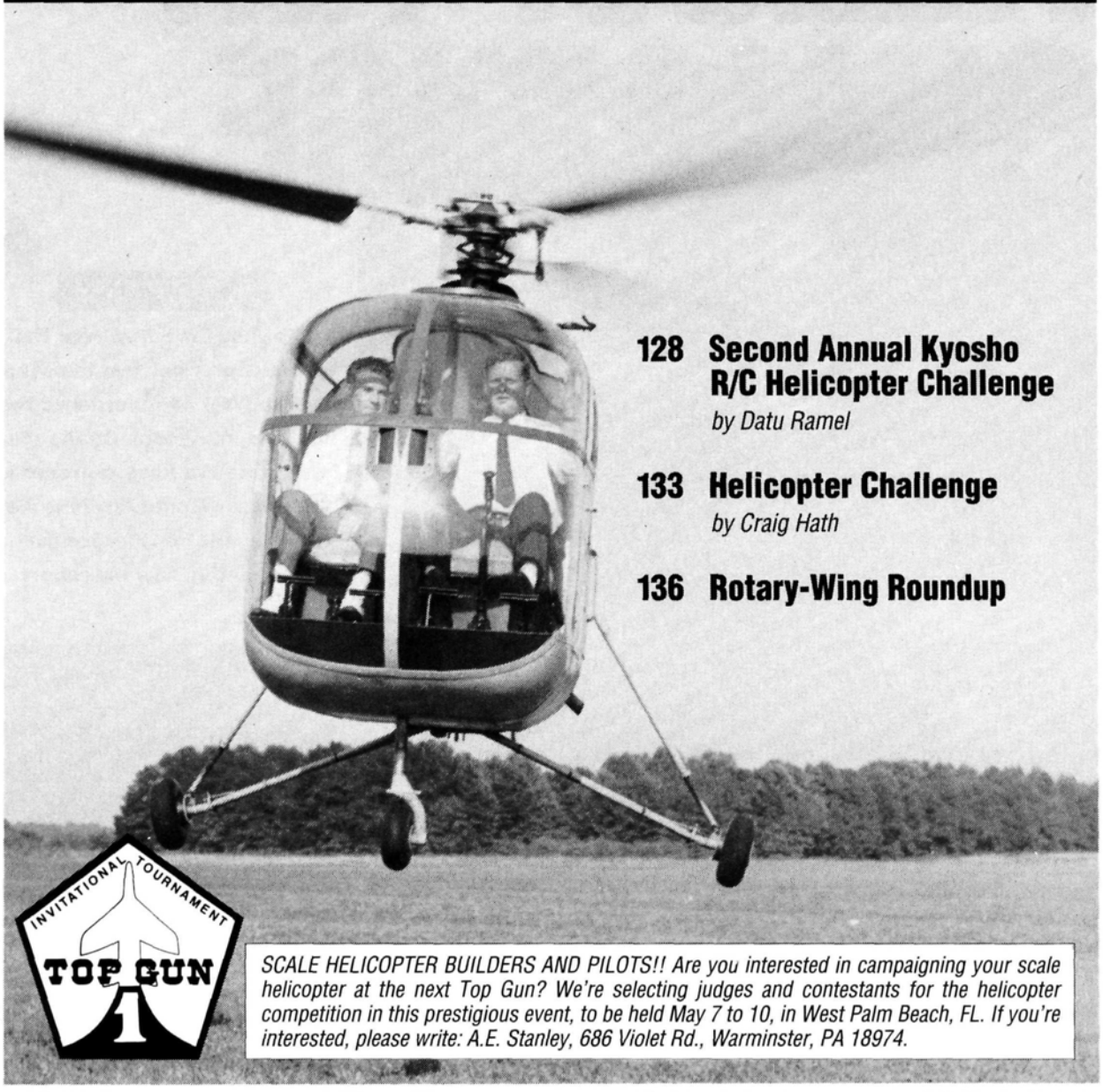
HELICOPTER SECTION

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by Craig Hath

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SCALE HELICOPTER BUILDERS AND PILOTS!! Are you interested in campaigning your scale helicopter at the next Top Gun? We're selecting judges and contestants for the helicopter competition in this prestigious event, to be held May 7 to 10, in West Palm Beach, FL. If you're interested, please write: A.E. Stanley, 686 Violet Rd., Warminster, PA 18974.

This month, Craig Hath offers helpful advice on basic setup parameters for your helicopter. Don't miss Datu Ramel's coverage of the Second Annual Kyosho Challenge for 30-size helicopters—this year, co-sponsored by Model Airplane News.

Photo: An early commercial version of the Army's XR-9B helicopter demonstrates hands-off hovering, which was said to be as simple as hands-off bike riding. Built by Firestone, the machine included a Lucite-enclosed cabin that offered a 270-degree range of vision. It's shown here being demonstrated for the first time at the Cleveland National Air Races.

2ND • ANNUAL

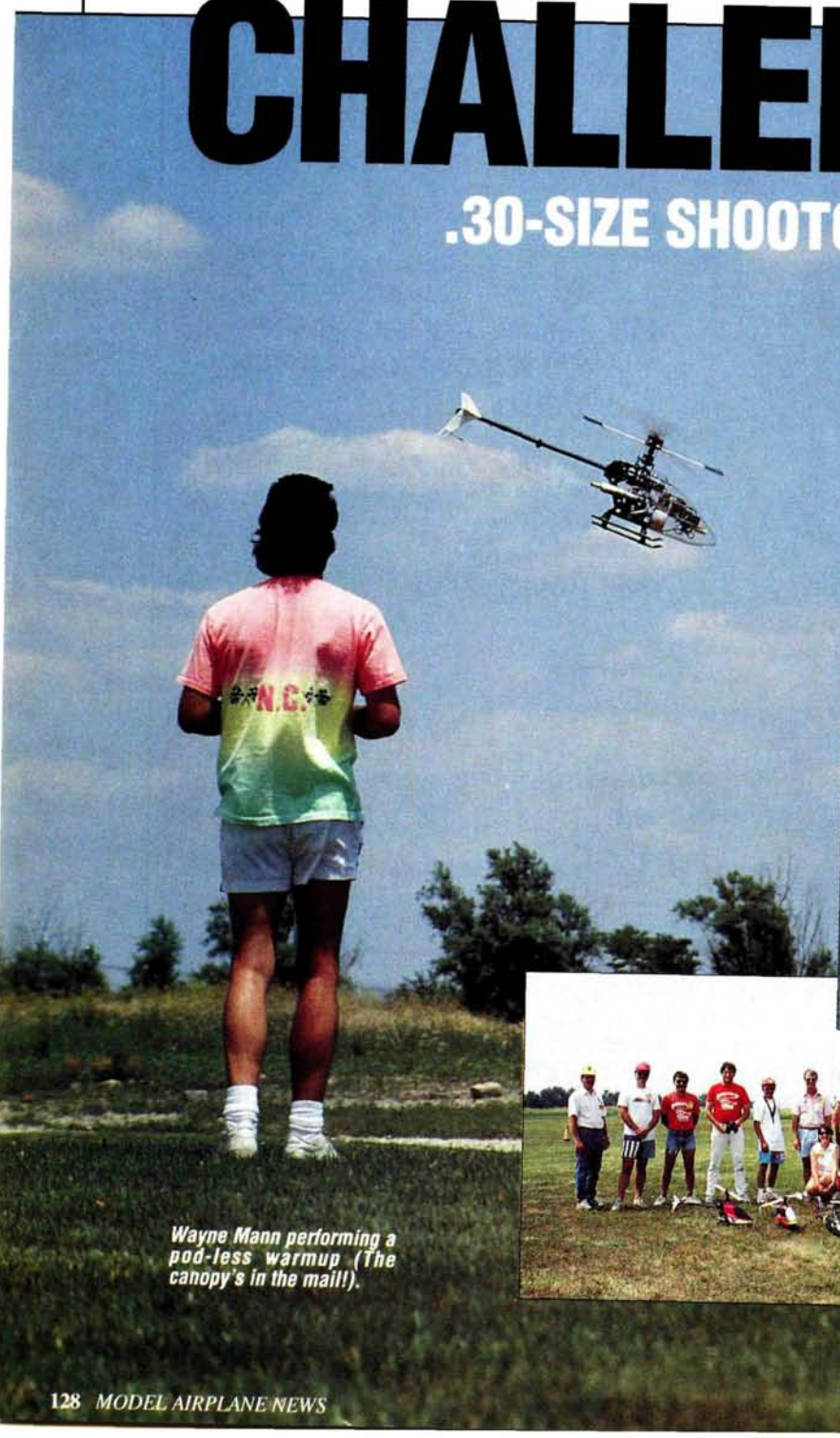
KYOSHO HELICOPTER CHALLENGE

.30-SIZE SHOOTOUT



by DATU RAMEL

CHAMPAIGN'S mid-year R/C helicopter contest is now a tradition; 69 pilots entered the 2nd Annual Kyosho Challenge. I'm pleased to have represented co-sponsor *Model Airplane News* at this event for .30-size machines, and here's my report.



Wayne Mann performing a pod-less warmup (The canopy's in the mail!).



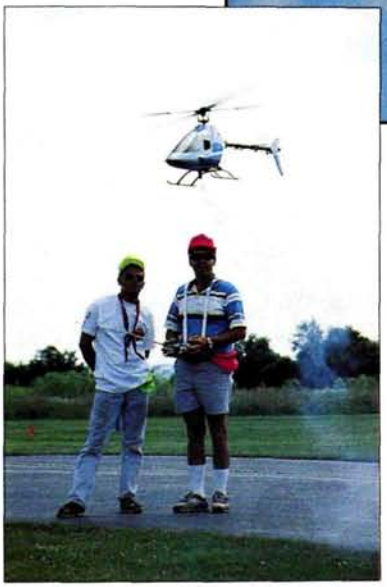
▲ *Dan Kelley's nicely finished SportCab with rivet detail around the windscreen. Paint by Terry Mineer.*

◀ *The Canadian delegation makes Nina Officer an honorary member.*



▲*Patrick Connell's highly visible Concept 30 SX in flight.*

I can't say enough about the Champaign County R/C Club's field. This spring, club members cut a lot more grass to prepare for the Kyosho Challenge. Fixed-wing pilots Mark Joseph and Larry Windingland helped Contest Director Tim Lampe enlarge the field so that he could have an additional Novice flight line. When FAI judge and former U.S. Worlds team manager Bob Harris got an eyeful of this and the two paved runways, he said, "This is for models?



Pete Cook watches Dwight Shiling's Concept 30 SportCab.

Like last year's Kyosho Challenge, all I had to do was listen to the pilots to get some new angles on the hobby. Bob Belluomini wryly observed that .30-size helis don't have the "presence" that .60-size helis have. When I wondered aloud why nobody auto rotated onto card tables anymore, Randy Gibson explained, "Because helicopters got more expensive." R/C Pattern veteran Bob Akers, however, won my Best Quote award with this gem: "In the '50s when proportional R/C systems were new, what you paid for a transmitter was the down payment on a nice Chevy Bel-Air Coupe."

NOTES ON WINNERS

Ted Schoonard won in Scale with a Miniature Aircraft Hughes 500E X-Cell. He put it through a classic Shovel maneuver (from the old FAI hovering schedule) that featured a 45-degree slow approach, quarter pirouettes, a half circle and sideways flight—all nose-in! Wayne Mann was impressed, saying "I've never done that maneuver, and I don't want to do it, either." In Novice, Mark Potts of Illinois flew a Concept and edged out Jim Robertson of Oklahoma. The state ranks were reversed in Intermediate; Oklahoman Kent Officer and his X-Cell beat Illinois residents Jeff Reed, Dan Costa and Orval Abney. There were no surprises in the FAI Pattern event as U.S. Worlds team member Wayne Mann outflew Kalt factory rep Yoshi Nagatsuka and former U.S. Champion Mike Mas.

Three women figured prominently in the contest results. In Novice, Nina Officer, Dana Labhart and Cindy Costs finished 11th, 17th and 33rd, respectively. Perhaps next year they'll be joined by Amanda Toliver, a Champaign-area student who worked at the concession stand and who won the Concept 30 raffle.

When Bob Harris got an eyeful of this and the two paved runways, he said, "This is for models?

TECHNICAL NOTES

Mark Potts's SX-upgraded Concept 30 used metal balls on the swash and at the servo arms, thrust bearings in the main blade grips and the

(Continued on page 131)

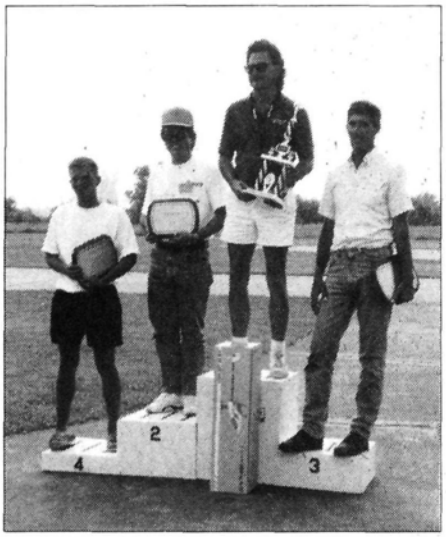


▲*Jack Reeves, of Minnesota, works on his Scale Concept .30 Jet Ranger.*



◀ *Florida pilot "Doc" Dunnell flies a Novice maneuver with Randy Gibson calling.*

Expert laminated wooden blades. The SX paddles and weights on the flybar and the DX soft dampers at the feathering spindles provided the "feel" and steadiness that Mark wanted for hovering. The collective-pitch settings were +1 degree at low stick (not 0 degree—there aren't any fast descents in Novice), +5 degrees at hover and +8 degrees at high stick. At the transmitter, Mark pulled the center of the throttle curve down a little to achieve constant head speed, and he flew with straight rates. Mark thought that his heli's tail setup made a big difference: he installed a Century imports tube drive to turn the tail rotor; he used Enforcer tail-blade grips so that he could install dual bearings; and he inserted a stiff wire pushrod through the tail-boom standoffs. Mark says that his modified tail rotor gave him much better control during side-wind headings.



FAI winners Wayne Mann (1st), Yoshi Nagatsuka (2nd), Mike Mas (3rd) and Pete Cook (4th).

At last year's Kyosho Challenge, Randy Gibson turned me on to the benefits of Tettra-bladder fuel tanks. This year, he gave me a tip on how to alleviate fuel foaming. Randy heard from some control-line speed pilots that you have to alter the fuel's surface tension, i.e., you need to add a surfactant that inhibits the fluid's ability to form bubbles. The secret additive is Armorall protectant—five to 10 drops for each gallon of fuel.



Novice winners Mark Potts (1st), Jim Robertson (2nd), Jim Brinicky (3rd) and Mark Ghebelian (4th).

Bob Akers displayed his new fiberglass fuselage—the Patriot—for .60-size helis. It looks very businesslike compared with some of the recent Japanese designs, e.g., the Blackshark, but, as with the older Hirobo Novos, the tip of its nose is high and there are no cosmetic scoops or fairings.

MANEUVERS TO REMEMBER

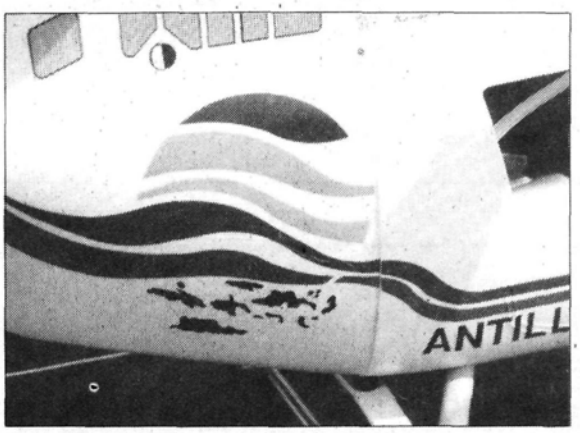
Kyosho factory pilot Kazuyuki Takayanagi performed consective sideways loops and exterior tail-first circles. He also hovered his Concept 60 prototype Jet Range fuselage inverted, down near the asphalt. Steve Gray made some neat loops and touch-and-go's with an Agusta 109 fuselage on tricycle landing gear. Big deal, you say? There was an electric Whisper in the fuselage! Pete Cooke made the lowest entries and exits in the FAI Pattern competition. It wasn't just his switched inverted maneuvering that impressed us; it was his stylish takeoffs. With a quick tail-first launch and a snap half-roll to inverted, Pete could make his machine go skids-up in the blink of an eye.

THE OLD UP AND DOWN

I asked Wayne Mann about the difference between flying .30s and .60s in competition. He

CAD GRAPHICS

Some of the helicopters at the 2nd Annual Kyosho Challenge had computer-aided design (CAD) graphics. Minnesotans Mark Johnston, Jack Reeves and Fred Hiatt had some attractive markings on their helis. A close look at Jack's tropical-island scheme revealed that its edges were too sharp to have been painted, yet there were none of the wrinkles, seams, or bubbles that you might find with decals or trim film. He explained that a sign-making shop in Minneapolis entered his PC-scanned graphics into a microprocessor-controlled blade (a plotter with an X-Acto knife?) that cut 3M Corel (pressure-sensitive colored film) into letters, stripes and palm trees. Corel is wrinkle-free because it's poured into a cast in a thin layer, not rolled like most films and tapes. Jack said that most big cities should have sign shops equipped to cut graphics in this manner.



A close-up of Jack Reeves' Jet Ranger graphics.

said that takeoffs and landings are more difficult with small machines because they weigh less. Russ Cox added that, in Novice, there's little else for the judges to look at *besides* the liftoffs and touchdowns. Pilots in this class can lose up to 2 points per judge (36 points in each round) based on how their helicopters rise to altitude or return to the pad. The lesson here is that first-year pilots can practice two of the most difficult elements of R/C heli competition every time they fly, even if they haven't attempted forward flight!

Tim Lampe had terrific support from the judges and officials. The Novice judges were Nick Anderson, Jamie Clancy, Al Jarboe, Kevin Mauney, Jeff Noffsinger and John Reiter; the Intermediate judges were Randy Gibson, John Meyers and Mike McClellan; and the FAI judges were John Adams, Bob Harris and Tom Unger. Many of Tim's fellow Great Planes employees worked on the flight line.

GREAT "FIRST CONTEST" EXPERIENCE

Bob Jakubowicz, who placed 25th in Novice, says that the Kyosho Challenge is a great "first-contest" experience. He taught himself to hover, and he had never even attended a fun fly before he entered last year's contest. He recalls that, for a guy who learned solo, it was a big jolt to be around so many pilots with such wide-ranging abilities. He was scared, but he received moral support from fellow first-time contest pilot Glenn Skanderup. Even so, it took Bob two rounds to shake off the first-day jitters. He got a whole new perspective on what R/C helicopter flying is all about—the precision that's required, the time pressure, the performance anxiety and the fear of choking. He recommends the .30-size Novice competition to any pilot who can hover in wind. This year, Bob came to Champaign with much more confidence in his flying abilities and his equipment, and he's a great example: you don't have to win to have fun!

I met Don Williams, a long-time fixed-wing pilot and CCRCC member, at the '90 Kyosho Challenge. He showed a keen interest in helicopters then, and this April, he learned hovering maneuvers. Two days before the contest, he flew his first circuit. Don enjoys the new and different world of helis. He told that me he has rediscovered the excitement of learning, and although he still loves to fly fixed-wing aircraft, some of his planes have become too easy to fly. At the '91 Kyosho Challenge, Don found himself in a situation where he was barely, if at all, comfortable, and he admits that his thumbs shook every time he flew. This year, he finished 31st, and he loved every minute of it.



Intermediate winners Kent Officer (1st), Jeff Reed (2nd), Dan Costa (3rd) and Orval Abney (4th).

The Novice class at the Kyosho Challenge is the one of the best "first" R/C helicopter contests anywhere. It's organized and run like a national meet (19 contest rounds in two days!) and the facilities are first-rate; yet the dozens of pilots against whom you compete have taught themselves to fly .30-size machines, just like you! See you in '92! ■

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Helicopter Challenge

The best control setup

by CRAIG HATH

I HOPE THAT you've had the chance to fly at least half as much as you've wanted to. It has certainly been hard for me to get out onto the field and fly; I've been burning the candle at both ends! Practice is the only way to improve, so fly as much as you can.

In this series of articles on precision flying and aerobatics, I've tried to simplify each step. I've described each maneuver, explained the control inputs and, whenever necessary, given details on special setups. This month, I'll discuss general helicopter setups and examine ways to make the best use of the equipment for specific types of flying.

SETTING UP

The best setup is one that will allow the helicopter to perform extremely smooth, precise hovering maneuvers, and then, at the flip of a switch, will allow it to make four rolls in 2 seconds. This setup is possible to a degree, but to really achieve the best setup for one flying style, you usually have to compromise. Even with sophisticated computer radios that support two or more flight modes, the mechanical throws and control linkages still greatly affect a helicopter's "feel" and response to the input from each servo.

Think of the rate of throw for any control as adjustable in percentages. Let's say that you attach the control linkage so that, when the servo is deflected to its full travel, the total amount of available throw is 1 inch. If this is the case, then, for every 10-percent control-rate decrement, there's $^1/_{10}$-inch or .10-inch throw decrement. If you reduce the total throw to $^1/_2$ inch, then every 10-percent control-rate decrement becomes a $^5/_{100}$- or .05-inch throw decrement. So much for the math lesson! For the purposes of this article, I'll refer to the setup with 1 inch of throw as base setup 1, and the one with a $^1/_2$ inch of throw as base setup 2.

BASICS WITH THE BASES

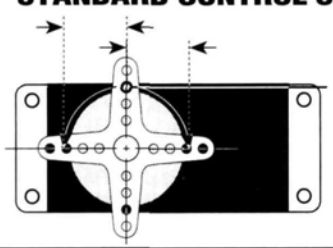
In base setup 1, if you move the transmitter's control stick 10 percent off neutral, there will be about .10 inch of throw; with setup 2, there would be .050 inch. (This assumes that the controls are perfectly linear, which may or may not be the case.) If you use the transmitter's dual-rate adjustments to reduce the servo throw, the results will be completely different in both setups. The helicopter will respond differently to the same amount of control input in either setup. Confused? Envision pulling the transmitter's cyclic control stick back halfway when the helicopter is in forward flight at full speed. If the heli is using setup 1, it will climb at a much sharper rate than it would if it were using setup 2.

Say that you want your helicopter to hover smoothly, but you also want maximum control throw to perform loops. You would use setup 1 and adjust the dual rates so that, when you move the cyclic-pitch stick from neutral to the half-stick position, the control throw would be the same as in setup 2. This would give you "soft" control in the low-rate position and "wild" control in the high-rate position. This setup generally works, but the control linkages must be completely free of slop, and you must use main rotor blades that are balanced (chordwise) forward of the center of lift.

Slop in the control linkage will increase as you reduce the control throw for smooth hovering. If the rotor blade is balanced at or behind the center of lift, the heli will jump or "pitch off" suddenly when you

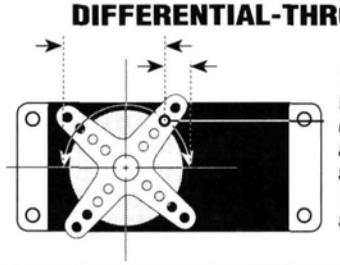
Differential throw

STANDARD CONTROL SETUP



The servo travel is equal in both directions.

DIFFERENTIAL-THROW SETUP



There's a lot of travel when the servo moves counterclockwise, and a little travel when the servo moves clockwise. The servo travel isn't the same in both directions.

make pitch changes. If there's 1 percent of free play in the base control linkage at 100-percent throw, then this play will be doubled when you cut the throw to 50 percent. Although this might not seem like much, you'll definitely notice the difference when you try to achieve a steady hover.

These setups apply mainly to pitch cyclic, roll cyclic and tail-rotor pitch. If you use them, it will be critical to set the collective pitch properly, because the radio systems that allow you to adjust the pitch curve do so by cutting off total throw at the very end of the servos' travel, and moving one or more hover- or center-servo positions. Such radios don't have low-rate collective pitch or even exponential-rate collective pitch. If these features were available, you could set the collective curve so that there would be maximum positive collective for autorotations and maximum negative pitch for inverted flight. Then, using the low-rate collective, you could reduce the pitch during hover so that the stick is less sensitive. Unfortunately, this isn't the case, so don't use more mechanical throw than necessary to achieve the desired collective pitch.

You can take this approach further by giving the collective-pitch linkage some differential throw. The idea is to mechanically adjust the servo output by hooking the linkage up off-center at the servo wheel. This might give you a pitch curve that, on a pitch gauge, would read: 7 degrees of negative pitch at low stick; 5 degrees of positive pitch at center stick; and 12 degrees of positive pitch at high stick. This would be before you made any pitch-curve adjustments at the radio. Admittedly, it takes some fiddling to get to this point, but the result is a stick that's less sensitive during hover and a large enough collective range for all kinds of flying.

Basic Setup Chart for the PCM-10

	FLIGHT MODE N	FLIGHT MODE 1	FLIGHT MODE 2
Low Pitch	-2°.	-4°	-7 1/2°
Center Pitch (Hover)	+9°	+2°	0°
High Pitch	+10°	+7 1/2°	+7 1/2°
Throttle Curve	Constant Speed from 1/3 throttle up	Constant Speed full range	Constant Speed full range
Dual-Rate Aileron	65%	Automatic 100%	Automatic 100%
Dual-Rate Elevator	65%	100%	100%
Total Swashplate Deflection (Roll)	1/4 inch	3/8 inch	3/8 inch
Total Swashplate Deflection (Elevator)	3/32 inch	1/4 inch	1/4 inch

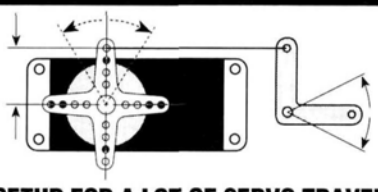
RADIO SETUP RUN-DOWN

I'll give you a run-down of the setups that I use with my JR PCM-10 radio and my Kalt Excalibur. The JR radio has a three-position flight-mode switch that lets me modify the pitch and throttle curves, the dual rate or the exponential throw and the tail-rotor torque compensation. I can set the last two items so that there's one set of values for the "N" mode (normal flight), and another set for flight modes 1 and 2. (Other radios, e.g., the JR X-347, have similar features.)

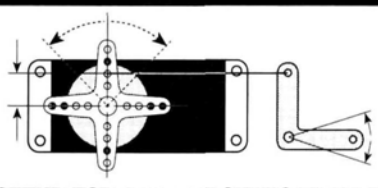
I use flight mode "N" for hover, and I set up the PCM-10 so that the helicopter has a fairly docile (low) rotor speed. I use flight mode 1 for smooth aerobatics and flight mode 2 for switchless inverted flight. Here's how each setup works with the Excalibur:

- **Flight mode "N"**—the pitch curve has some differential throw; there's -2 degrees at low stick, +9 degrees in hover and the total pitch at high stick is +10 degrees. I adjust the throttle curve so that there's constant rotor speed from 1/3 stick through full throttle, and I set the low rates for pitch and roll cyclic to 65 percent.
- **Flight mode 1**—the pitch curve shifts in a straight line from a low-stick setting of -4 degrees to a high-stick setting of +7 1/2 degrees. I adjust the throttle curve to produce constant rotor speed throughout the pitch range. I set the roll- and pitch-cyclic controls so that they'll automatically change to 100-percent throw when I activate this flight mode, and I use just enough roll-cyclic throw to make rolling stall turns easy. The PCM-10 also enables me to set up a second set of trims electronically for straight, level forward flight without upsetting the hover trims.

Effects of slop



SETUP FOR A LOT OF SERVO TRAVEL



SETUP FOR A LITTLE SERVO TRAVEL

Slop is greatly reduced when the servo throw is set-up mechanically with only the necessary amount of throw.

You've probably

(Continued on page 144)

ROTARY-WING ROUNDUP



CENTURY
AH-1S Tow Cobra

Century's custom fuselage kit of the Gulf War AH-1S Tow Cobra helicopter is done in an Alaska Army color scheme. The kit includes: a clear canopy; a pilot station; a laser-finder dome; a machine-gun dome and guns; a rocket base and a rocket tube; factory-built, scale, landing gear, mounting hardware and a damper; a flexible tail-drive system; plywood, balsa and hardwood; and an instruction manual and blueprint (1:1 scale). The Tow Cobra can accept X-Cell, Kalt, Hirobo and GMP rear-exhaust engines (Hirobo and GMP shaft drives only).

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For more information, contact Century Import & Export, 521 Sinclair Frontage Rd., Milpitas, CA 95035; (408) 942-9525.



ROBBE/SCHLUTER
Magic 60 L

Robbe now offers Schluter helicopters with clockwise or counterclockwise rotation systems. The new Magic 60 L retains all the qualities of the Magic 60, but its mechanics have been designed to accept a spur gear that reverses its rotor system's rotation.

Part no. S2884

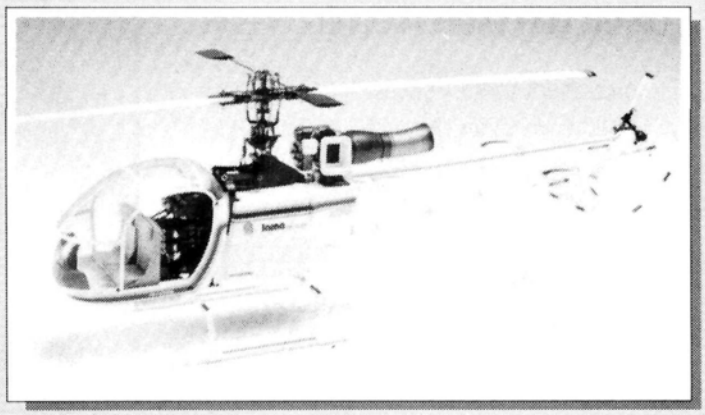
For more information, contact Robbe Model Sport, 170 Township Line Rd., Belle Mead, NJ 08502.

HIROBO
Lama SA-315B

Hirobo's Lama SA-315B helicopter accepts parts used in Shuttle series helis, and it has a main frame that's compatible with the new scale series helis. It features a shaft-driven tail-rotor system and a scale tail-truss assembly, and it can accommodate an MRB-III three-blade rotor head (available separately). Specifications: main-rotor diameter—1,240mm; length—1,110mm; weight—3,100g; engine required: .32 to .46.

Part no. 0402991

For more information, contact Hirobo/Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61824.





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This piece is often called an anti-rotation link. It's designed to eliminate the friction-induced swashplate motion that's caused by the spinning of the main-rotor shaft. This means that if a forward-cyclic command is given to the swashplate, you get only forward motion. If this radius arm weren't present, you might get forward- and right-cyclic motion, assuming the rotor spins to the right like those on all Shuttles. This part gives more precise control.

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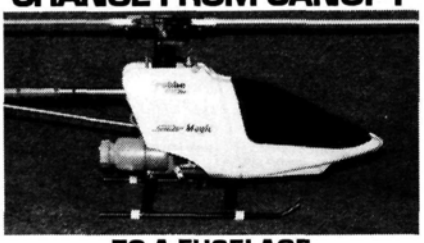
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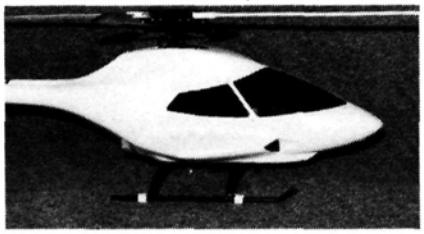
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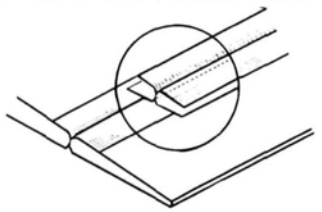
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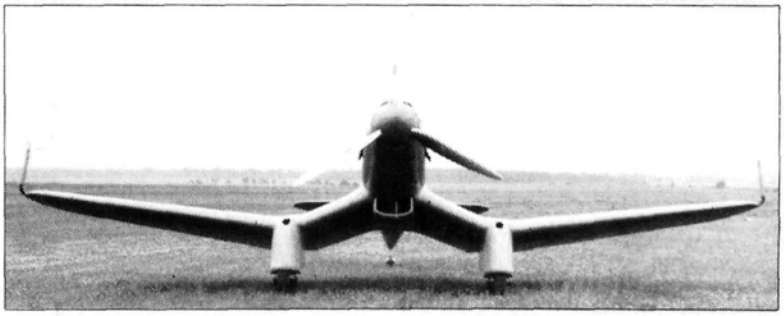
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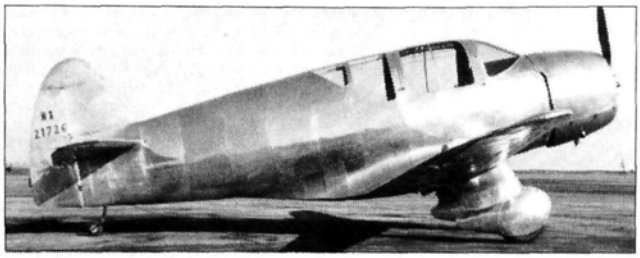
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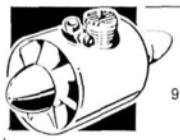


Congratulations to Mr. John McSwiney of Newington, CT, for correctly identifying the mystery plane in the September issue. John's entry was chosen from 14 correct ones.



The Paulic XT3-B was a two-place, all-metal aircraft designed by John Thorpe. Built by Rudy Paulic of United Airlines in 1939, it became the prototype aircraft for the Boeing School of Aeronautics. The plane had all-metal control surfaces, and it was powered by a 125hp Warner Scarab engine. Mr. Paulic built the aircraft in his backyard, mostly by hand and in his spare time. This is a fine example of a home-built aircraft. The XT3-B was also featured in *Model Airplane News'* November 1939 issue in the "Frontiers of Aviation" column by Robert Morrison.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.



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HELICOPTER CHALLENGE

(Continued from page 134)

noticed that there's less top-end pitch in flight mode 1 than there is in flight mode "N." This "two-speed" setup works well in FAI competition, but you have to be careful when you flip the switch, because the heli will jump and the rotor speed will change substantially between the two modes.

• **Flight mode 2**—I set the pitch curve for -7 1/2 degrees at low stick to +7 1/2 degrees at high stick. Again, I set the throttle curve to provide constant speed throughout the pitch range. This is the switchless inverted curve. When the collective/throttle stick is in the low position, the throttle opens 100 percent, and this lets me fly the helicopter inverted (it's similar to flying an airplane upside-down). The throttle hold also has its own pitch, and I set it for -3 degrees at low stick to +12 degrees at high stick. This is the autorotation pitch curve.

I hope that I haven't given you too much information all at once! Try to set up for the style of flying that you want, and keep the compromises to a minimum. Next month, I plan to return to the basics of how to get started in this super sport! ■

CLUB OF THE MONTH



Wichita Falls R/C Club,
P.O. Box 4796, Wichita Falls, TX 76308

Doug Powell, editor of the "Broken Prop," puts together a well-done, informative publication. The minutes of the last meeting covered topics such as flying-field improvements and working with the city to get club projects approved. Also mentioned was new club member Charlie Frey, who made his first successful solo flight under the guidance of Mike Wilson. The model of the month, the crash of the month and the winner of the club's door prize made for amusing reading.

The Jaycee Park flying-field improvements—a major effort for all involved—required jackhammers, digging, pouring cement, tamping and troweling, hauling away old concrete, back-filling and leveling the ground in the pit area. With the addition of the new park benches and the proposed safety nets between the pits and the runway, this flying field will be a dream come true for any R/C pilot.

Also included in the newsletter was a fitting obituary for John Clemens, former AMA president and good friend to all who knew him.

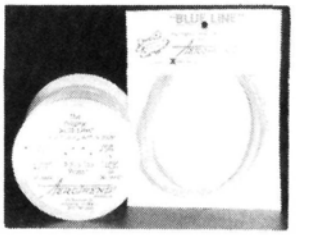
For all their hard work and effort, we're sending the Wichita Falls R/C Club two, one-year subscriptions. Congratulations!

We encourage all modeling clubs to send us their newsletters, and we want to hear about the activities of new clubs. Who knows—your club may be the next "Club of the Month." ■

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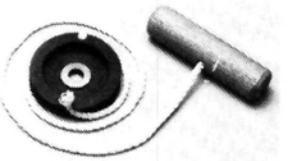
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A complete set of 10, jeweler-fine files for every hobby and craft use. This needle file set features round-handled files of tough, tempered steel in a handy plastic pouch. Spade, flat, square, round and taper files are included in the assortment.

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The SNAPPER
An R/C Combat-Style Sport Model For Glow or Electric Power



- *Kit includes illustrated instructions, a hardware pack, a formed canopy and machine- and die-cut parts made of high-quality balsa and plywood.*
- *May be flown with .05 electric power or .049 to .11 glow-engine power. Parts and instructions for both versions are included.*
- *It's compact! Ready to fly, it easily fits in the back seat of your car.*
- *Offers solid, big-plane performance. It's a small plane that flies like a .40!*
- *Accepts standard-size servos.*

$49.95 List

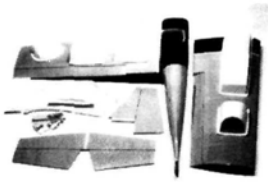
Wingspan: 34 inches • Area: 288 square inches
Weight: 7 ounces—bare airframe:
22 to 26 ounces—ready to fly (glow powered)
33 to 36 ounces—ready to fly (electric powered)

See your hobby dealer first. If he doesn't stock the SNAPPER, order direct.
Include $2.50 S&H with direct orders.

AEROCRAFT P.O. Box 553, East Northport, NY 11731 • (516) 369-5886

New Giant Scale TR-260+ Pre-Built

(All wood - no foam)



John Eaton s TR-260+
List Price $895.00

Intro Price $595.00

Fully Aerobatic lazer-type hand-built in Thailand form Balsa & Ply. Covered in two-tone Ultracote™. ABS Cowl, hatch cover & wheel pants. Fiberglass options & full replacement parts available. Excellent slow flight characteristics.

Wing span: 92" Length: 65"
Weight: 16-19lbs. Power: 2-4 cu. in.

Special combo with Magnum II engine $695.00

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MAGNUM II ENGINE - 2.5 cu. in.

This 2.5 cu. in. flys a 25 lb. plane with ease. Reed valve induction produces 4 H.P. & 8000 RPM on regular gas. One piece forged steel crank supports full bearing rod. Suggested prop sizes: 18-10, 18-14, 20-10, 22-8. Complete, ready-to-run engine includes muffler & aluminum mount. Choice of 6-bolt hub or 1-bolt hub.

4.5 lbs, 7.75 x 5.25 in. Special price $149.95

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Address for J&K Products listed below.

New Giant Scale TR-260 Kit



John Eaton s TR-260
List Price $325.00

Intro Price $249.00

Kit version of the pre-built. Aerobatic lazer-type mid-wing with symmetrical air foil. Kit includes full size plans, gear, canopy, ABS cowl, hatch cover & wheel pants. All parts die-cut balsa & ply (no foam). Fiberglass options, accessories and full replacement parts available.
Excellent slow flight characteristics.

Wing span: 90" Length: 65"
Weight: 15-18 lbs. Power: 2-4 cu. in.

Special combo with Magnum II engine: $349.00

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Address for J&K Products listed below.

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Intro Price $500.00

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S&H $15.00 COD add $5.00 CA res. add tax
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J&K Products (A division of Model Center)
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(213) 327-3862 (Check, Money Order, or COD only)

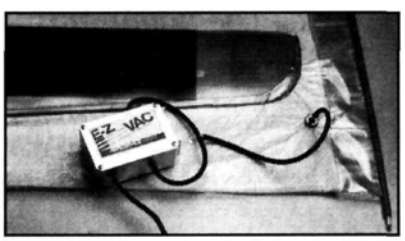
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